

BULLETIN OF MISCELLANEOUS INFORMATION

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ROYAL BOTANIC GARDENS, KEW

XXXV — POA SERIES BULBOSAE ROSHEV. OF
PALESTINE AND SYRIA. NAOMI FEINBRUN (Hebrew
University, Jerusalem).

The series *Bulbosae* has recently been distinguished from the Sect. *Bulbophorum* Asch. et Gr. by Roshevitz (1934). This series comprises those species of *Poa* whose sheaths of radical leaves are thickened to form small bulbs tunicated by sheaths of preceding years. The region of concentration of species which comprise this group is the Irano-Turanian (Eig, 1931). While the European species of Sect. *Bulbophorum* have been studied in some detail (Ascherson and Graebner, 1900; Hegi, 1907; Achtaroff, 1939), little was known of the Asiatic group of species until rather recently. In the Flora URSS (1934), a revision of the Russian species of this group is given by Roshevitz. No revision, however, of the species of the Near East has been made since Boissier (1884). These are insufficiently known both taxonomically and phytogeographically. We may cite the following passage on the S. European *P. Timoleonitis* Heldr. (*P. bulbosa* ssp. *Timoleonitis*) by Achtaroff (1939, 130): "Meiner Schätzung nach muss diese Unterart als das letzte und das xerophilste Glied in der phylogenetischen Entwicklung der Sektion *Bulbophorum* betrachtet werden."

A revision of this group from Palestine and Syria seems thus to be desirable.

The species belonging to this group and reported from Palestine are as follows (Post, 1896, 1933; Eig, 1932):—(1) *P. bulbosa* L., (2) *P. sinaica* Steud., (3) *P. Hackeli* Post.

For Syria two more species are recorded:—(4) *P. macroglossa* Hack. and (5) *P. Timoleonitis* Heldr.

However, since Post no new data have been obtained on the last four species.

This revision is based on the abundant material preserved at the Herbarium of the Hebrew University, Jerusalem, and collected by the staff of the Botanical Department during phytosociological and phytogeographical studies conducted especially in the steppe and desert sections of Palestine, Syria and Iraq. We were also able to examine the material found at the Dinsmore Herbarium (Jerusalem) and the Post Herbarium (Beirut).*

* The author wishes to express her gratitude to Mr. J. E. Dinsmore for placing at her disposal the material of his Herbarium and for help in procuring the type specimens of Post's Herbarium.

1. Rhachis of spikelet always bearing long fleece at the base of the lower pales. Height of plant 15-30 cm.....**P. bulbosa** L.
Rhachis of spikelet destitute of long fleece at the base of the lower pales, or, when bearing a few long hairs, height of plant 35-50 cm.....2
2. Ligules of radical leaves and tips of membranous sheaths enveloping the bulbils, 2-4 mm. long, produced above the tufts; blades densely scabrous at the margins and along prominent nerves (fig. 2b, c).....3
Ligules of radical leaves and tips of membranous sheaths short, generally not produced; blades sparsely scabrous at the margins (fig. 3b, c).....4
3. Sheaths of radical leaves obovate, scarcely 1 cm. long; their ligules about 4 mm. long, generally entire, continued as broad margins of the sheath (fig. 5b). Plant 10-20 cm., rarely 25 cm. high. Spikelets 6-10-flowered.....**P. Timoleontis** Heldr.
Sheaths of radical leaves usually more than 1 cm. long, oblong; ligules about 2 mm. long, generally fringed; plants 15-25 cm. high and then 4-5-flowered, or tall plants, 30-35 cm. high, with 6-7-flowered spikelets (Moab).....**P. sinaica** Steud.
4. Plants 10-25 cm. high forming dense and short tufts; glumes 2-2.5 mm. long; panicle 2.5-5 cm. long; sheaths of radical leaves about 1 cm. long.....**P. Eigii** Feinbr.
Plants 35-50 cm. high growing in small, mostly isolated tufts; lower glumes 3-3.5 mm. long; panicle 5-10 cm. long; sheaths of radical leaves 2-3 cm. long.....**P. Hackeli** Post

ENUMERATION.

Poa bulbosa L. Specimens seen*:—Palestine: Upper Galilee: Ramah (1927 Smoly); Birket-Ram (1925 Smoly). Mt. Carmel, near Haifa (1923 E). Judean Mountains: Jerusalem, Mt. Scopus (1931 Amdursky); Jerusalem, Gehenne (1924 E); Wadi Shiban (1930 FZ); Motsa (1924 E); env. of Bethlehem (1924 E). Amman: env. of Ain Sueli (1929 EZ). Moab: Medaba (1911 Meyers & Dinsmore). Syria: Amanus Mts., Col de Beylan, 700 m. (1932 Delbes); sortie Est d'Antioche, 100 m. (1935 Delbes); ca. Aleppo (1931 Z); Lebanon, Brummana (1900 Warburg); Antilebanon (1930 Warburg).

The outstanding differential characteristic of this species, as compared with other species of this group, is the presence of long crisp fleece on the rhachis of the spikelet at the base of the lower pales

* Abbreviations:

Collectors: E—Eig, F—Feinbrun, G—Grizi, Z—Zohary.

Herbaria: DH—Dinsmore Herbarium, American Colony, Jerusalem.

PH—Post Herbarium, Beirut.

When not otherwise mentioned the specimens are from the Herbarium of the Hebrew University, Jerusalem.

(fig. 1a). *P. bulbosa* is a rather low grass (15–30 cm. high), forming small, more or less isolated tufts, with inflated bulbils at the base (fig. 1b). In Palestine, this species shows forms transitional to *P. Hackeli* Post (see below). Viviparous forms are rather frequent.

According to its geographical range this species is a plant of the Euro-Siberian-Boreo-American, Mediterranean, and Irano-Turanian regions (Eig, 1932). Roshevitz (1934) reports this species from European Russia, W. Siberia, and the Caucasus (Euro-Siberian-Boreo-American region), and from Middle Asia (Irano-Turanian region). In Palestine and Syria, however, we found it only in the eu-Mediterranean territory. There it generally appears in the last degradation stages of the constantly destroyed shrub associations, and occasionally in somewhat ruderal localities. Eig, Feinbrun, and Zohary (1934) regarded it chiefly as an Irano-Turanian species. This was based on the fact that they comprised under the name *P. bulbosa* four different species, *P. bulbosa*, *P. Hackeli*, *P. sinaica*, and *P. Eigii*. The associations in which *P. bulbosa* is given by them as principal indicator refer to the last two species which are actually Irano-Turanian. Only the following passage can be referred chiefly to the true *P. bulbosa*: "In Mediterranean Palestine *P. bulbosa* is a leading plant of an association of a very limited extension, but the genesis of this association reveals rather a secondary origin."

It is a matter of doubt whether the *P. bulbosa* of the United States is conspecific with the European plant. It is most probably a separate species, differing in height (it is 30–60 cm. tall) and in several other characteristics (Halperin, 1931, Hitchcock, 1935). Halperin, who gives a detailed description of the Californian *P. bulbosa*, does not mention the fleece of the rachis. The species is given as introduced from Europe. If so, it would be an interesting case of a new type developed during a few hundred of years at most.

P. Hackeli Post. Specimens seen:—Palestine: Judean Mountains: Solomon's Pools (1886 Post, type !, PH); Jerusalem (1924 E); Wadi Rijan (1930 FZ); Kiryath Anavim (1923 E). Acre Plain: Jidro (1927 Smoly). Sharon: Herzlia to Arsuf (1926 Z). Shefelah: Gedera (1927 EFZ); Shekhunath Borokhov (1927 EFZ). Near Negeb: Tel Milh (1922 E); Tel Arad (1922 E). Syria: Col de Beylan (1932 Delbes); ca. Riha (1931 Z); ca. Aleppo (1931 Z); Bshetfin (1899 Post, PH). S. Turkey: Aintab (1887, Post, type !, PH); Midyat (Post, type !, PH).

Post (1897) distinguishes this species from *P. bulbosa* as follows: "Species *P. bulbosae* L. affinis praesertim glumella carina marginibusque rigidule pectinato-ciliata basi non protrahendo-lanata distincta (In *Poa bulbosa* cilia mollia, basi convexa, lana protrahenda)." The most important difference thus would be the long fleece at the base of the lower pales of *P. bulbosa*. The examination of the three type specimens of *P. Hackeli* Post (1, Solomon's Pools; 2, Aintab; 3, Midyat) from Post's Herbarium (Beirut) showed, however, that their florets were not altogether destitute of long

crisp hairs. At the base of the 1-3 lower florets we found 2-3 long hairs, while the upper ones were destitute of them or bore 1-2 shorter hairs. These hairs could be easily distinguished from the rather long cilia of the keel and margins. In our Herbarium, however, we found many species of *P. Hackeli* completely destitute of fleece on the rhachis (fig. 4a). On the other hand we possess other specimens forming a series of transitions from the true *P. bulbosa* to *P. Hackeli*.

Another important characteristic of *P. Hackeli* is its height. Post gives it as "planta sesquipedalis," i.e. about 50 cm. high and so are the type specimens from Aintab and Midyat (S. Turkey), while that of Solomon's Pools (Palestine, S. of Jerusalem) is only about 35 cm. high; the specimens of our Herbarium are 35-50 cm. high. As given by the majority of European Floras, the height of *P. bulbosa* is 15-30 cm. Our specimens of *P. bulbosa* correspond, therefore, to these measurements. However, we also possess a few specimens transitional both in presence of fleece and height between *P. Hackeli* and *P. bulbosa*, so that it is difficult to decide in which of the two species they should be classed. These transitional forms may have been produced at the meeting place of *P. bulbosa* and *P. Hackeli* by hybridization, or else *P. Hackeli* may be regarded as a more or less recent derivative of *P. bulbosa* still connected by transitional forms with its maternal species. At all events *P. Hackeli* seems to be nearer *P. bulbosa* than other Palestinian and Syrian species of the series *Bulbosae* Roshev. All other species of this region are completely destitute of fleece.

Other important characteristics of this species are: growth in small tufts remote from one another and almost destitute of remnants of preceding years (however it is not annual as described by Post); culms geniculate at base; radical leaves with very short not produced ligules and their sheaths 2-3 cm. long (fig. 4b) and their blades about 5 cm. long, generally scabrous only at the margins; panicle 5-10 cm. long.

P. Hackeli is an East-Mediterranean species. In Palestine it is chiefly restricted to non-eu-Mediterranean parts of the country. It occurs on the one hand on the light soils of the coastal plain, where it is rather common in natural non-Mediterranean associations (as *Helianthemum elliptici* and others). On the other hand, it is found in the eastern and southern parts of the Judean Mountains, bordering on the Irano-Turanian Judean Desert and Negeb.

Poa Eigii Feinbr., sp. nov.; affinis *P. bulbosae* L., *P. Hackeli* Post, et *P. sinaicae* Steud., sed a prima flosculis lana non connexis, caespitibus densis compactis, a secunda plantis minoribus, vaginis foliorum basaliū brevioribus residuis vaginarum vetustarum dense obtectis, paniculis brevioribus, a tertia ligulis foliorum basaliū brevioribus, vaginis haud membranaceo-marginatis, laminis mollioribus glabris margine scabriusculis, glumis acuminatis, glumellis brevioribus differt.

Perennis, dense caespitosa ; culmi erecti, 10–25 cm. alti, basi bulbiformi-incrassati et foliorum vaginis residuis dense tecti ; folia convoluta, tenuia, glabra, margine scabriuscula, radicalia numerosa, 2–4 cm. longa, ligulis brevibus (1–1.5 mm. longis), vaginis 1–1.5 cm. longis saepissime violaceis marginibus membranaceis destitutis ; panicula anguste oblongo-lanceolata, 2.5–5 cm. longa, ramis brevibus strictis ; spiculae confertae, ovatae ; flosculi 3–5, lana non connexi ; glumae subaequales, ovato-oblongae, acuminatae, 2–2.5 mm. longae ; glumella oblonga, acutiuscula, saepe breviter mucronata, carina et margine dense et longe ciliata. Spiculae in gemmas foliiferas saepe mutatae.

Specimens seen :—Palestine : Judean Desert ; km. 18 on the Jerusalem-Jericho road (1935 EZG, type !) ; Ain Hod (1935 EZ) ; Tal'at ed Dam (1935 EZ). Near Negeb : E of Tel-Arad (1934 EFZ) ; Qurnub to Beersheba (1934 EFZ).

This species differs from *P. bulbosa* L. chiefly in the lack of connecting fleece and in its dense compact tufts forming great patches or surfaces. From *P. Hackeli* Post it differs in the smaller size of the plant ; in the short sheaths of the radical leaves, which are densely covered by the residues of sheaths of the preceding years ; in the shorter panicle ; the smaller lower glume (2–2.5 mm., not 3–3.5 mm. long). From *P. sinaica* Steud. it can be distinguished by short, generally not produced ligules of the radical leaves, not continued as a broad membranous margin of the sheath (fig. 3b) ; by softer and glabrous leaves, scabridulous only at the margins (fig. 3c) ; by acuminate, more unequal glumes and shorter lower pales (fig. 3a).

Phytogeographically this species is to be regarded as belonging to the Irano-Turanian element. It is an endemic possessing a restricted area (only Judean Desert and Near Negeb), but there it is very important phytosociologically. It is an important component of several Irano-Turanian plant associations and forms their spring aspect (as for instance in *Noaea mucronata*—*Poa Eigii* association, *Ononis Natrux*—*Poa Eigii* association, etc.). Its high sociability is most remarkable. The plant vegetates for a very short season ; the green colour that its tufts give to the mountain slopes at the beginning of the rainy season soon changes into a yellowish colour.

P. sinaica Steud. The confusion surrounding this species was probably caused by Boissier (1884). His description of the lower pales is erroneous and runs as follows : “ . . . glumella . . . undique plus minusve pruinoso-scabrida,” and further : “ Ab affini *P. bulbosa* foliis tenuissimis, panicula angustiore, flosculis lana destitutis, glumellis undique pruinosis vel glabratis nec lineatim sericeis distincta. *P. concinna* Gaud. . . differt . . . glumella ad carinam et margines sericea ” (p. 606). This is rather puzzling because the original diagnosis of Steudel (1855, 256) is very clear on this point : “ flosculis . . . margine dorsoque pilosis caeterum glabris.” Probably

in accordance with Boissier, Schweinfurth described his var. *aegyptiaca*, reported by Muschler (1912, 135) as follows. "This variety differs from the typical form by . . . the flowering glumes with dense ciliate nerves." It is obvious that the var. *aegyptiaca* Schweinf. is identical with the type of *P. sinaica* Steud.

In Post's Herbarium, Beirut, there are several sheets of this species. One of them was determined by Hackel who, however, considered this species as "eine schwache Art" (in the letter to Post mentioned below). The eminent agrostologist probably did not have at his disposal a sufficient number of specimens and ignored the phytogeographical importance of this species. Now there is no doubt that *P. sinaica* is a good species; within this species we were even able to distinguish several paramorphs. It is also recognised as such by Roshevitz (1934).

The most characteristic features of this species are the following : —(1) Ligules of radical leaves and tips of membraneous sheaths usually enveloping the bulbil, produced above the tuft; length of ligule about 2 mm. (2) Blades of radical leaves very narrow, convolute, densely scabrous at the margins and along the prominent nerves of the lower surface (fig. 2c). (3) Bulbils oblong, often scarcely inflated below, densely covered by residues of sheaths of preceding years. (4) Tufts rather dense; culms generally not geniculate.

The following paramorphs were distinguished :

P. sinaica Steud. ssp. **typica** Feinbr. ssp. nov.

Plantae 15–25 cm. altae; flosculi 4–5; paniculae ramuli breves.

var. **aegyptiaca** Schweinf.

Glumellae margine dorsoque ciliatae.

Some of the specimens seen : Sinai : Near Tih, Escarpement (1882 Post, HP). Palestine : Moab : S. of Ziza, 700 m. (1937 Dinsmore No. 10571, HD). Edom : Ain Musa, near spring (1929 EZ); 40 km S. of Ma'an, Nubian sandstone (1929 EZ); Aneze to Ma'an (1929 EZ); 12 km. S. of Jurf ed Derawish, 1000 m., Artemisietum Herbae albae (1936 EFZ); 9 km. N. of Aneze, 1050 m., Halogetonum alopecuroides (1936 EFZ). Syria : Ain el Wa'ul to Ain el Beidha; Nebk to Karyetein; Karyetein to Ain el Wa'ul (1890 Post, det. Hackel, PH); Tell esh Shamat, 87 km. E. of Damascus; 366 km. E. of Damascus; 538 km. E. of Damascus; Wadi Muhammadi, 105 km. W. of Ramadi; 47 km. E. of Ramadi (all : 1933 EZ); 65 km. E. of Deir es Zor (1939 Dinsmore, HD); Jebel Mukeibra, 30 km. W. of Soukhne, 800 m., 17 km. W. of Hussetché, 320 m.; 120 km. S. of Homs, 1430 m. Iraq : 9 km. N. of Tauq (betw. Baquba and Kirkuk); 140 km. N.E. of Deltawa, 180 m.; 35 km. N.W. of Kirkuk; 21 km. N.W. of Kirkuk; 15 km. N. of Altum Keupri, 320 m.; Jebel Atshan (E. of Mosul), 500 m.; 10 km. N.E. of Tel Abu Dahir, 400 m.; 35 km. N.W. of Mosul, ca. 540 m.; 2–3 km. N. of Balad Sindjar, 600 m. (all : 1933, EZ).

var. **glabrescens** *Feinbr.* var. nov.

Glumella tota glabra.

Specimens seen: Palestine: Edom: 23 km. S.W. of Ma'an (1936 EFZ type); Ain Musa, near spring (1929 EZ).

ssp. **moabitica** *Feinbr.* ssp. nov.

Planta elata (30–50 cm.); foliorum radicalium vaginae 3–4 cm. longae; panícula diffusa, usque ad 13 cm. longa et 5 cm. lata; rami elongati, inferiores 5–6 cm. longi, pedunculi ramorum parte reliqua saepe longiores. Spiculae 6–7-florae; glumella glabra.

Specimens seen: Palestine: Moab: Ziza to Um el Ammud (1929 EZ type); Amman to Ziza (1929 EZ).

The geographical area of *P. sinaica* is wide, and extends over Galala of Egypt, Sinai Peninsula, the steppe parts of Transjordan, Eastern Syria, and the Syrian Desert up to Iraq. It probably continues through Persia and is reported from Transcaucasia and Russian Middle Asia. *P. sinaica* is a typical steppe plant and, in the Near East at least, is very important phytosociologically. In the *Poa bulbosa*-*Carex stenophylla* and *Phlomis Bruguieri*-*Poa bulbosa* associations mentioned by Eig, Feinbrun, and Zohary (1934), the name *Poa bulbosa* must be replaced by *Poa sinaica*. The same relates to the *Poa bulbosa*-*Carex stenophylla*-*Ranunculus asiaticus* association characteristic of oviposition fields of the Moroccan locust. (Eig, 1935).

P. Timoleontis *Heldr.*—The record of this species from Syria in Post's Flora is based upon one specimen from El Beidha to El Jebah (Syrian Desert). This specimen, marked No. 5, was sent for determination to Hackel who designated it in his letter to Post as "genau gleich den Original-Exemplaren." Comparing this specimen with the specimens of *Heldreich* 104 we find that it is rather untypical as to its ligules, forming a transition to *P. sinaica* from which *P. Timoleontis* was never differentiated. The differential characteristics of *P. Timoleontis* are: (1) Ligules of radical leaves longer (3–4 mm.) and broader than in *P. sinaica* (fig. 5b). (2) Sheaths of radical leaves obovate, not oblong, with broader membranous margin. (3) Leaves setaceous, narrower than in *P. sinaica*. (4) Spikelets 6–10-flowered. (5) Height of plant 10–25 cm.

Phytogeographically *P. Timoleontis* differs from *P. sinaica*, which is an Irano-Turanian species. The area of *P. Timoleontis* is the Balkan Peninsula reaching as far as S. Dobrogea in the north; it grows often in community with *P. bulbosa* (Hermann, 1939). The isolated station of this species in the Syrian Desert is rather curious. Further findings are necessary to confirm its occurrence there.

At the same time there is evidence for assuming that the so-called *P. macroglossa* Hack. from Aintab (S. Turkey) is the viviparous form of *P. Timoleontis*. We shall now discuss this species.

P. macroglossa was published first in Post's Flora (1896) with reference to a letter of Hackel ("Hackel in letter"). The letter,

dated 1890, is found attached to the type specimen of this species in Post's Herbarium. The respective passage may be cited here: "Die *Poa* von Aintab ist sehr interessant. Mit *P. bulbosa* ist sie nicht nahe verwandt, sondern mit *P. alpina* L., doch scheint sie mir auch von dieser durch die sehr grosse gezackte Ligula hinlaenglich verschieden zu sein. Jedoch kann ich auf Grund des einzigen Halmes kein sicheres Urtheil abgeben, umsoweniger als das uebersandte Exemplar kein normales, sondern *vivipar* ist. Aber auch hierbei verhaelt es sich anders als *P. alpina* und *P. bulbosa*. Denn bei letzteren entspringt die aus der Spelze hervorwachsende Laubblattspreite (lamina) aus der Spitze, bei Ihrer *Poa* aber auf dem Ruecken. Ich glaube demnach wohl annehmen zu duerfen, dass es sich hier um eine neue Art handelt, welche ich provisorisch (wegen der grossen Ligula) *P. macroglossa* nenne; allein ich wuerde dieselbe nicht eher publizieren, bis ich davon mehr Material und namentlich auch Exemplare mit entwickelten *Blueten* (nicht Brutknospen, propagula, vulgo "flores vivipari") gesehen haben werde. Vielleicht gelingt es Thoren naechstes Jahr, solche zu erlangen." However, as testified by the remark of Post (1896 and 1933), normal specimens of the species have never been collected. He wrote: "The only specimens thus far seen are the so-called viviparous forms." No other specimens are found in Post's Herbarium. As emphasised by Hackel, it is impossible to establish a species upon a few viviparous specimens. To ascertain if the curious ligules of the viviparous bulbils occur in *P. sinaica*, we examined many viviparous specimens of this species, but found none similar to those of Aintab. However, the description of the viviparous form of *P. Timoleonitis* given by Hermann (1939) corresponds fairly well to *P. macroglossa*. It is curious that on one of the two sheets of *P. macroglossa* we found the following remark made by Post: "Barbey in Plantae Postianae, 14, says that it is *Poa Timoleonitis*, Heldr. forma *vivipara*" (cf. Pl. Postianae, fasc. 1, p. 14). *P. macroglossa* must be thus regarded as conspecific with *P. Timoleonitis*. This widens the geographical range of this species further east to S. Turkey and the Syrian Desert. More detailed investigation of the plant in this part of its area, especially with regard to its phytosociology, would be desirable.

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XXXVI—SOME FUNGI FROM AFGHANISTAN.

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In the summer of 1939 I paid a hurried visit, lasting about six weeks, to Afghanistan. The trip, which began on the 25th of June, covered nearly 2700 miles in the northern, eastern and southern parts of the country. The north-eastern part, comprising the Pamirs and Nuristan, the central part known as the Hazarajat and the western part, comprising the province of Herat, could not be visited as the roads had been damaged and bridges washed away by the unprecedented floods of the previous spring.

Afghanistan is for the most part a mountainous country, but in the north stretches a vast prairie-like region, the southerly extension of the great central Asian Steppe. The mountains are mostly barren and vegetation is rather scarce. In the valleys which are traversed by the rivers, however, principal among which are the Kabul and the Kunduz, intensive cultivation is carried on by the people. The rivers are in spate in the late spring and early summer, but for the rest of the year they are usually dry. Annual precipitation is chiefly in the form of snow in winter; rain is scarce.

Conditions on the whole apparently did not favour the growth and development of fungi, and the damage due to them in fields, orchards and vineyards was negligible. Both because of the scarcity of fungi and the hurry with which the journey was made, there was little time to make either close observations or any extensive collections. The few collections that were made have been

identified, and, as they may be of interest, are listed below. They are deposited in the *Herbarium Cryptogamicum Indiae Orientalis* of the Imperial Agricultural Research Institute, Delhi.

I wish to place on record my gratitude to Mr. A. M. Mustafa, Agricultural Officer, Baluchistan, and the leader of the party that visited Afghanistan, for the interest he took in my work and the help he rendered. I also wish to thank Mr. Mohammad Taslim of the Mycology section of this Institute for the aid he gave in making the identifications.

Phycomycetes.

PERONOSPORALES.

Cystopus candidus (Pers.) De Bary.

On leaves and stems of *Brassica Napus* L. Char-e-khar.

Cystopus Ipomoeae-panduranae (Schw.) Stevens and Swingle.

On leaves of *Ipomoea* sp. Paghman.

Plasmopara viticola (Berk. et Curt.) Berl. and De Toni.

On leaves of *Vitis vinifera* L. (Cult.) Kandahar.

Peronospora aestivalis Sydow.

On leaves of *Medicago* sp. Phul-i-kumri.

Peronospora Viciae (Berk.) De Bary.

On leaves of *Vicia* sp. Paghman.

Ascomycetes.

PERISPORIALES.

Uncinula necator (Schw.) Burr.

On leaves and berries of *Vitis vinifera* L. Kandahar.

DOTHIDEALES.

Phyllachora Cynodontis (Sacc.) Niessl.

On leaves of *Cynodon Dactylon* (L.) Pers. Kalat-e-gilzai.

HYPOCREALES.

✕ *Ustilaginoidea virens* (Cooke) Takahashi.

In ovaries of *Oryza sativa* L. Laghman valley.

Basidiomycetes.

USTILAGINALES.

✕ *Entyloma Oryzae* Sydow.

On leaves of *Oryza sativa* L. Laghman valley.

✓ *Sphacelotheca Sorghi* (Link) Clinton.

In ovaries of *Sorghum halepense* (L.) Pers. Mazar-i-shariff.

clans] ✕ *Tilletia foetida* (Wallr.) Liro.

In ovaries of *Triticum vulgare* Vill. Road-side between Mukur and Kalat-i-galzai. Leg. T. Ahmad.

✕ *Urocystis Tritici* Koernicke.

On leaves of *Triticum vulgare* Vill. South of Kabul, on Ghazni road.

Ustilago Cynodontis P. Henn.

In inflorescence of *Cynodon Dactylon* (L.) Pers. Baglan.

Ustilago Hordei (Pers.) Lagerh.

In ovaries of *Hordeum vulgare* L. (Cult.) Khanabad, Chardeh-ghorbund.

Ustilago Kolleri Wille.

In ovaries of *Avena sativa* L. Aibak.

Ustilago nuda (Jens.) Rostrup.

In ovaries of *Hordeum vulgare* L. (Cult.) Bamian.

Ustilago Triticici (Pers.) Rostrup.

In inflorescence of *Triticum vulgare* Vill. Baglan, Balkh, Khanabad, Ghazni, Mukur.

UREDINALES.

✕ *Aecidium Mori* Barclay.

On leaves of *Morus alba* L. Isstalif, Char-e-khar.

✕ *Melampsora Lini* (Pers.) Lév.

On leaves and stems of *Linum usitatissimum* L. Bhutkak, Baglan.

Puccinia artemisiella Sydow.

On *Artemisia* sp. Kunduz.

Puccinia Cynodontis Desm.

On leaves of *Cynodon Dactylon* (L.) Pers. Ghazni.

Puccinia glumarum (Schm.) Eriks. et Henn.

On leaves and culms of *Triticum vulgare* Vill. Mukur, Bamian, Ghazni.

Puccinia graminis Pers.

On culms of *Avena sativa* L. Chardeh-ghorbund. On culms, leaves, and glumes of *Triticum vulgare* Vill. Bhutkak, Ghazni, Balkh, Tashqurkhan, and Bamian.

Puccinia Taraxaci Plowr.

On leaves of *Taraxacum officinale* Weber. Kabul.

Puccinia tritici Eriks.

On leaves and culms of *Triticum vulgare* Vill. Chardeh-ghorbund.

✕ *Uromyces Fabae* (Pers.) De Bary.

On leaves and pods of *Pisum sativum* L. Kabul.

Uromyces Hobsoni Vize.

On stems, petioles and leaves of *Jasminum* sp. Paghman.

Fungi Imperfecti.

MONILIALES.

✕ *Alternaria Solani* (Ell. et Mart.) Jones et Grout.

On leaves of *Solanum tuberosum* L. Kabul, Gulbagh.

✕ *Cercospora beticola* Sacc.

On leaves of *Beta vulgaris* L. Baglan.

✕ *Cercospora concors* (Casp.) Sacc.

On leaves of *Solanum tuberosum* L. Kabul.

Cercospora neriella Sacc.

On leaves of *Nerium odorum* Soland. Rishkhor (Kabul).

' *Helminthosporium Oryzae* Breda de Haan.

On leaves and glumes of *Oryza sativa* L. Laghman valley.

× *Helminthosporium teres* Sacc.

On leaves of *Hordeum vulgare* L. Ghazni.

MELANCONIALES.

× *Septoria Tritici* Desm.

On leaves of *Triticum vulgare* Vill. Kunduz.

XXXVII — CONTRIBUTIONS TO THE FLORA OF
BURMA: XVIII.* C. E. C. FISCHER.

The regions quoted in round brackets are those from which the species concerned has been reported previously.

Anemone vitifolia Ham. [Ranunculaceae] (Sikkim, Mishmi).

Seinghku Valley, 2150 m., fls. early Aug. *F. Kingdon Ward* 7245: "In meadow. Sepals white, slightly flushed purple on reverse; anthers golden."

Ranunculus scleratus Linn. [Ranunculaceae] (N. India, N. Temperate zone).

Nsop, 150 m., fls. and frt. end March, *Ward* 6606: "In wet sand in the open bed of the river, growing with *Polygonum*. Fls. butter-yellow."

Ilex Hookeri King [Aquifoliaceae] (Sikkim).

Seinghku Valley, 2935 m., fls. early June, *Ward* 6860: "Small shrub in dense thickets, open situations on the steep sheltered face of the valley. Fls. cream."

Dipentodon sinicus Dunn [Celastraceae] (W. China).

Seinghku Wang, 2300 m., fls. end May, *Ward* 6779: "In thickets on the edge of the 'dry' forest. Fls. cream, young anthers crimson." Near Kan-fan, 26°16' N., 98°47' E., 2770 m., *Forrest* 26540: "In mixed forests on the W. flank of the divide. Fls. grey-green." 25°58' N., 98°29' E., 2460 m., fls. May, *Forrest* 26561: "In open thickets by streams in the hills. Fls. green-white." N.E. Burma, 2450 m., *Forrest* 2448, without date or precise locality: "In mixed forests."

In the original description of this genus and species (K.B. 1911, 310) Dunn refers to the difficulty of discovering its affinity. He placed it provisionally in the family *Celastraceae*. I am of opinion that it is better fitted into the *Samydaceae* (*Flacourtiaceae*, *sensu* Pflanzenfamilien), and akin to the genus *Casearia*. In this opinion I receive some support from Dr. C. R. Metcalfe, who kindly undertook to make anatomical comparisons between this plant and a

* Continued from K.B. 1940, p. 186.

species of *Casearia* and of one species of each of the genera of *Celastraceae* quoted by Dunn. He finds the anatomical characters of *Dipentodon* very similar to those of *Casearia* but still more so to those of *Perrottetia*, and it seems probable that the latter genus also should be transferred to the *Flacourtiaceae*. The question, however, demands much further investigation and until this has been done the genus may be left where Dunn placed it.

The leaves are sometimes ovate and the base may be cuneate or emarginate. The perianth of 10 segments appears to me to be inseparable into sepals and petals. The disk lines the perianth-tube.

Photinia rufa C. E. C. Fischer, sp. nov. [Pomaceae]; prope *P. mollem* Hook. f. ponenda, tomento rufo, corymbis minoribus atque magis compactis, calycis dimidio superiore glabro, disco glabro differt.

A small tree; branchlets and older twigs nearly black (when dry); twigs of the year densely fulvous-tomentose. *Leaves* elliptic, acuminate, base cuneate, 4-6.2 cm. long, 1.4-2.3 cm. wide, midrib slightly impressed above, raised below as are the 5-8 parallel, nearly straight primary nerves, ultimate network very fine, above olivaceous (when dry) and glabrous except that occasionally the midrib near the base is pubescent, pale below and densely fulvous-tomentose on the midrib and nerves, less so between them, margins evenly denticulate except for the basal third; petioles 4-10 mm. long, channelled above, densely fulvous-tomentose; stipules absent, presumably early caducous. *Corymbs* terminal on the twigs, up to 3.5 cm. diam., many-flowered; rhachis, its branches and pedicels more or less densely rufous-tomentose; pedicels 2-5 mm. long; bracts linear-ensiform, acuminate, 5 mm. long, caducous; bracteoles filiform. *Calyx* turbinate, rufous-tomentose in lower half, glabrous above, 3.5 mm. long; lobes triangular-lanceolate-ovate, subacute, 1.5 mm. long. *Petals* broadly obovate or trapezoid, obtuse, base narrowed but hardly clawed, 3.5 mm. long, reflexed in flower. *Stamens* about 20; filaments subulate, 2-2.5 mm. long, glabrous; anthers subglobose. *Disk* thin, lining the calyx-tube. *Ovary* 2-celled; crown glabrous; ovules 2 in each cell; styles 2, very shortly united at the base, 3 mm. long. *Fruit* not seen.

Seinghku Wang, 2770 m., fls. May, *Ward* 6756: "In the tangle-wood forest. Fls. white; fragrant."

Saxifraga nigroglandulosa Engl. et Irmsch. [Saxifragaceae] (Yunnan).

Seinghku Valley, 28°10' N., 97°20' E., 3400-3700 m., fls. early Oct., *Ward* 7544: "On rocky shrub-clad slopes. Fls. bright-orange with darker spots." 4100 m., fls. early Oct., *Ward* 7565: "Commonest rock Saxifrage at 3700-4100 m., forming clumps amongst stones. Fls. either bright-orange with darker spots or bright-sulphur with orange spots."

Saxifraga stella-aurea *Hook. f. et Thoms.* [Saxifragaceae] (Sikkim, Tibet).

Seinghku Wang, 3400–3700 m., fls. late July, *Ward* 7206: "On boulder slopes. Fls. bright-yellow with orange spots."

Osbeckia yunnanensis *Franch. ex Craib* [Melastomaceae] (Yunnan).

Seinghku-Adung confluence, 1230 m., fls. Aug., *Ward* 7287: "In thickets; 2–3 m. high. Fls. pinkish-purple."

Trichosanthes Wallichiana *Wight* [Cucurbitaceae] (Sikkim, Khasia, Malaya).

Seinghku Valley, 2150 m., fls. early Aug., *Ward* 7248: "Climber in thickets; keeping in the open. Fls. pink."

Heracleum candicans *Wall.* [Umbelliferae] (Kashmir to Kumaon).

Seinghku Valley, 28°10' N., 97°20' E., 3700–4000 m., fls. and frt. Oct., *Ward* 7561: "Amongst mossy boulders and stones in dry gullies. Fls. white or tinged purple."

Oenanthe Thomsoni *C.B. Clarke* [Umbelliferae] (Sikkim to Khasia).

Seinghku Valley, 2150 m., fls. early Aug. *Ward* 7254: "In damp, boggy meadow. Fls. white; scented."

Pleurospermum dentatum *Benth.* [Umbelliferae] (Kumaon to Sikkim).

Seinghku Valley, 28°10' N., 97°20' E., 3400–3700 m., fls. and frt. Oct., *Ward* 7560: "In colonies amongst moss-covered stones in the steep rock-bed of a torrent (now dry). Fls. white; whole plant scented."

Helwingia himalaica *Hook. f. et Thoms.* [Araliaceae] (Sikkim to Khasia, W. China).

Seinghku Wang, 1550 m., fls. May, *Ward* 6714: "Small shrub with weak, drooping branches; epiphytic on trees in the jungle by the river. Leaves highly polished; flowers green tipped with purple, anthers cream."

Macropanax undulatum *Seem.* [Araliaceae] (Sikkim to Assam).

Nogmung Nam Tisaing, 450–670 m., and by the Nam Tamai at 1240 m., fls. April–May, *Ward* 6644: "Long, limp scrambler, stems many feet in length growing up through thickets in the jungle. Fls. pale-green."

Schefflera glauca (*Clarke*) *Harms* [Araliaceae] (Assam).

Seinghku Valley, 2150–2800 m., fls. Sept., *Ward* 7503: "Tall, slim, unbranched, palm-like tree of the upper temperate rain-forest. Fls. cream."

Leycesteria glaucophylla *Hook. f.* [Caprifoliaceae] (Sikkim).

Seinghku Wang, 2150 m., fls. end May, *Ward* 6777: "Small straggling bush in alder copse in the stony river-bed. Fls. pale-sulphur or greenish."

Viburnum erubescens Wall. [Caprifoliaceae] (Kumaon to Bhutan, Dekkan, Ceylon).

Seinghku Wang, 2600 m., fls. May, *Ward* 6744 : " Shrub or small tree on open bracken-clad slopes or in bamboo thickets. Fls. hanging in bunches, chalk-white ; slightly fragrant."

Viburnum tricostatum C. E. C. Fischer, sp. nov. [Caprifoliaceae] ; prope *V. Davidii* Franch. atque *V. cinnamomifolium* Rehd. ponendum, ab utroque foliis chartaceis, inflorescentiae rhachi pubescente, corolla tubulari differt.

A tree 7–10 m. high ; twigs terete, the terminal sulcate, brownish when dry, sometimes with a purplish tinge, glabrous, sparingly minutely pustulate. *Leaves* opposite, chartaceous, elliptic or elliptic-oblong, caudate-acuminate, base narrowed and rounded, sometimes slightly inequilateral, 9–19 cm. long, 3–5 cm. wide, 3-ribbed from 2–6 mm. above the base, the ribs running to the apex, sometimes in a continuous gentle curve and at others indented at the junction with the very few usually oblique primary nerves, a number of finer nearly horizontal veins between, ultimate network small, glabrous, olivaceous (when dry) above with the ribs, nerves and reticulations slightly impressed, yellowish-green below and abundantly but obscurely punctate, margins entire or with a few minute, distant teeth in the apical third ; petioles 1.3–2.5 cm. long, narrowly channelled above, often pustulate. *Corymbs* terminal, umbel-like, 3–4 cm. wide ; peduncles 1.5–2.5 cm. long, sparingly pubescent as are its branches, primary branches 4–7, 1.4–2 cm. long, secondary 3–4, 6–10 mm. long, both furrowed (at least when dry) ; pedicels 2–3 mm. long ; bracts linear 5 mm. long ; bracteoles appressed to the ovaries, oblong, truncate, 1.5 mm. long. *Ovary* turbinate or oblong, angled, 1.7 mm. long, 1-celled. *Calyx* very short ; lobes 5, short, broad, obtuse. *Corolla* tubular ; tube 4.5 mm. long ; lobes 5, rounded, 0.7 mm. long, 1.5 mm. wide. *Stamens* 5, inserted about $\frac{1}{3}$ above the base of the corolla ; filaments strap-shaped, 4.5 mm. long ; anthers oblong, pendent, 1.5 mm. long, exserted. *Style* broadly conical, 1 mm. long ; stigmas 2. *Fruit* not seen.

Seinghku Wang, 2000 m., fls. end May, *Ward* 6802 : " In thickets. Corolla violet, anthers violet."

Brachytome Wardii C. E. C. Fischer, sp. nov. [Rubiaceae] ; *B. Wallichii* Hook. f. valde affinis, ramulis foliisque infra puberulis, inflorescentia pubescente, cymis brevioribus atque magis compactis, corollis brevioribus atque latioribus differt.

A small *shrub* ; lateral twigs sulcate on the upper side near the leaves, brownish, rather densely brown-puberulous, especially at the apex. *Leaves* elliptic-oblong to oblanceolate or obovate, rather abruptly caudate, narrowed to the slightly inequilateral base, when one of the pair of leaves is suppressed the other is broad and equilateral, 17–20 cm. long, 5.5–7.5 cm. wide, midrib and 10 pairs of primary nerves prominent below, the latter anastomosing near the

margins, joined by usually straight or oblique, infrequently branched veins, when mature glabrous above, puberulous on the nerves below, dark-brown or olivaceous above when dry, paler below ; petioles 5–10 mm. long, of the single leaves the longer, densely puberulous. *Cymes* in the axils of suppressed leaves, up to 2.5 cm. long ; basal bracts small, loosely enfolding the peduncles ; peduncles up to 5 mm. long, with its branches, pedicels, bracts and bracteoles densely appressed fuscous-pubescent ; bract narrowly ensiform, finely acuminate, 2 mm. long ; pedicels 3.5 mm. long ; bracteoles like the bracts, minute. *Ovary* subglobose or oblong, 4 mm. long, puberulous. *Calyx* cupular, 2 mm. long, puberulous ; teeth 5, minute, distant. *Corolla* rather broadly funnel-shaped ; tube 6.5 mm. long, 3.5 mm. diam. at the mouth, glabrous outside, villous in the upper half within ; lobes 5, overlapping clockwise in bud, subcircular, 2.3 mm. diam. *Stamens* 5, inserted above the middle of the corolla-tube ; filaments very short ; anthers linear, included, 3.3 mm. long, dorsifixed below the middle. *Crown* of ovary cushion-shaped, 0.7 mm. high. *Style* stout, 2.5 mm. long, stigmatic lobes 2, elliptic, subacute, 3.5 mm. long. *Fruit* not seen.

Seinghku-Adung confluence, 1380 m., fls. May, *Ward* 6702 : “ In thickets as jungle undergrowth. Fls. cream ; slightly scented.”

***Lasianthus Wardii* C. E. C. Fischer et K. N. Kaul**, sp. nov. [Rubiaceae] ; *L. tubifero* Hook. f. valde affinis, ramulis fistulosis hirsutis, foliis subtus magis hirsutis, petiolis brevioribus hirsutis, stipulis hirsutis, calyce brevior differt.

A *shrub* ; twigs compressed, fistular, fuscous hairy. *Leaves* chartaceous, distichous, elliptic-oblong to oblanceolate-oblong, caudate-acuminate, base cuneate, 12–17 cm. long, 3.5–6 cm. wide, midrib and 7 pairs of primary nerves raised below, dark-olivaceous (when dry) and glabrous above, brown and fuscous-hairy, especially on the nerves, below ; petioles 5–10 mm. long, hairy ; stipules short, broadly ovate, cuspidate, margins toothed or not. *Inflorescence* of few-flowered, sessile or shortly peduncled fascicles. *Ovary* cupular, brown-hairy, 4 mm. long, crown cushion-shaped, 1.2 mm. high, 5-loculae ; ovules oblong, compressed. *Calyx* brown-hairy on both sides ; tube very short ; lobes 5, oblong, obtuse, 3 mm. long. *Corolla* tubular below, funnel-shaped above, short brown-hairy outside ; tube 1.6 cm. long, 5 mm. diam. at the mouth, whitish- or brownish-pilose in the apical two-thirds within ; lobes 5, triangular-ovate, subacute, 4.5 mm. long. *Stamens* 5, in the corolla throat ; filaments 1 mm. long ; anthers included, linear, 2.5 mm. long, basifixed. *Style* slender, widened at the apex, 7.5 mm. long, minutely brown-puberulous ; stigmas 3, sometimes 5, linear, 1.4 mm. long. *Fruit* not seen.

Nam Tamai, 920–1070 m., fls. early May, *Ward* 6679 : “ Hanging over cliffs in the river bed. Fls. white or pale-purple, upper face of corolla-lobes purple.

Leptodermis gracilis C. E. C. Fischer, sp. nov. [Rubiaceae]; prope *L. lanceolatam* Wall. ponenda, ramulis cinereis gracilioribus, foliis fere glabris, pedunculis floribusque brevioribus, bracteolarum dentibus brevioribus trinerviis differt.

A shrub; branches long, thin, eventually drooping, ash. Leaves opposite, membranous, elliptic to lanceolate, acute, base cuneate, more or less decurrent, 1.4–3.5 cm. long, 5–13 mm. wide, primary nerves 4–6 pairs, glabrous except for the sparingly hispidulous midrib and sometimes near the margins above, olivaceous (when dry) above, paler below, margins hispidulous-ciliate; petioles 2–6 mm. long; stipules interpetiolar, long cuspidate from a broad base, 3 mm. long, minutely puberulous and ciliate. Inflorescence terminal and from the upper axils, forming a thyrse; peduncles striate, angular, 3.5 mm. long, minutely puberulous; flowers sessile in threes; bracts narrowly elliptic-lanceolate, acute, 4 mm. long, ciliate; bracteoles united into a 2-toothed, chartaceous sheath, tube 2.5 mm. long, teeth ovate, apiculate, 1 mm. long, 3-veined. Ovary turbinate, strongly 5-ribbed, 1.2 mm. long. Calyx campanulate; tube 0.7–1 mm. long; lobes 5, oblong, rounded or truncate, 1 mm. long, ciliate. Corolla narrowly funnel-shaped; tube very slender, 8 mm. long, pubescent in the upper $\frac{7}{8}$ within; lobes 5, ensiform, subacute, 1.5 mm. long. Stamens 5; anthers sessile, inserted on the throat of the corolla, included, linear, 1.5 mm. long. Style very slender, shortly exserted; stigmas 3, filiform, 1–1.5 mm. long, papillose. Capsules linear-oblong, 5-valved, 5 mm. long. Seeds fallen.

Zayul River: Kahao, 1500 m., fls. July, Ward 7182: "Compact, almost spiny shrub on the open hillside; lanky in shaded thickets. Fls. white or purple."

Dipsacus inermis Wall. [Dipsacaceae] (Kashmir to Bhutan).

Seinghku Valley, 28°10' N., 97°25' E., 2770–3100 m., fls. Oct., Ward 7603: "Meadow plant, 1–1 $\frac{1}{2}$ m. high. Fls. cream with purple stamens."

Morina betonicoides Benth. [Dipsacaceae] (Sikkim).

Seinghku Wang, 28°8' N., 97°24' E., 3400 m., fls. early July, Ward 7033: "On granite boulders in the open valley. Fls. purple, darker in the centre; very fragrant." Ward 7065: "On grassy banks with *Nomocharis* and *Iris*. Fls. white, tinged purple."

Veronica himalensis Don [Scrophulariaceae] (Himalayas, Nepal to Sikkim, S. Tibet).

Seinghku Wang, 28°8' N.: 97°24' E., 3400 m., fls. end June, Ward 7008: "On steep earth-bank facing South. Fls. blue."

Edgeworthia Gardneri Meissn. [Thymelaeaceae] (Nepal to Bhutan, China, Japan).

Seinghku Wang, 2770 m., fls. May, Ward 6758: "On very steep, rocky, rather open slopes where there are no trees, only thickets;

common in the valley below at 1250 m., but there the fls. are long since over. Fls. at first golden-yellow, later fading to white; leaves appear after the fls. are over."

XXXVIII—NEW SPECIES AND RECORDS FROM TIBET : II.*

The regions quoted in round brackets are those from which the species concerned has been previously reported.

Geum elatum Wall. [Rosaceae] (Kashmir to Sikkim).

Hills East of Yatung, 3700 m., fls. June, *B. J. Gould* 2096.

Potentilla latipetiolata C. E. C. Fischer, sp. nov. [Rosaceae]; *P. articulatae* Franch. similis sed planta minor, caulibus simplicibus, foliis cum petiolis latioribus haud articulatis, bracteolis oblongis differt.

A perennial herb; root woody, 3–4 cm. long; caudex short, together with the stems concealed by the densely imbricate leaves, 1–2 cm. long. Leaves digitately 3-foliolate; leaflets rigid, sessile, linear-oblong, obtuse, 5–6.2 mm. long, 1–2 mm. wide, pubescent and with an apical tuft of hairs, margins revolute (at least when dry), 1-ribbed; petiole 4–8 mm. long, 2–3 mm. wide, including the adhering bases of the stipules; stipules adhering to within 1 mm. of the leaflets, free portion linear-ensiform, up to 3.3 mm. long, pubescent. Flowers very few, axillary, solitary; peduncles 8 mm. long, sparingly hairy; bracts 2, opposite, linear-oblong, acute, 6 mm. long, thinly hairy; pedicels 3 mm. long, thinly hairy. Sepals 5, ovate, acute, 4 mm. long, greenish, purple-splashed. Bracteoles 5, oblong, obtuse, 2–3.5 mm. long. Petals 5, nearly circular, not clawed, 6 mm. long, apex entire, emarginate or 3-lobulate, golden-yellow. Stamens 20 or more; filaments slender, 2–2.5 mm. long, glabrous; anthers small. Disk white-villous. Carpels many, oblong, gibbous on one side, 1.3 mm. long, green, the apex often purple, glabrous; style lateral from close to the apex, slender, 2 mm. long, hooked at the apex; stigma capitate, minute. Fruit not seen.

Rama to Dumpa Gompa, 4900 m., fls. end June, *Gould* 2272.

In the specimens the individual plants are separate, in nature they may be aggregated to form cushions; the leaves form a globose or oblong mass around the stem 1.5–2 cm. long and about 1.5 cm. in diameter.

Potentilla purpurea Royle [Rosaceae] (N.W. Himalayas).

Rama to Dumpa Gompa, 4900 m., fls. end June, *Gould* 2261.

Sanguisorba filiformis (Hook. f.) Hand.-Mazz. [Rosaceae] (Sikkim).

Tuna to Khambu, 4900 m., fls. July, *Gould* 2349.

* Continued from K.B. 1940, 269.

Saxifraga subsessiliflora Engl. et Irmsch. [Saxifragaceae] (Sikkim).

Rama to Dumpa Gompa, 4900 m., fls. end June, *Gould* 2271.

Saxifraga tangutica Engl. [Saxifragaceae] (Sikkim).

Melung Gompa, 4900–5230 m., fls. early July, *Gould* 2244.

Saxifraga tentaculata C. E. C. Fischer, sp. nov. [Saxifragaceae]; *S. flagellari* Willd. affinis sed caulibus glabris, foliis ad basin et apicem aggregatis, petalis multo brevioribus 5-nerviis distat.

A stoloniferous herb; rootstock not seen; stem solitary, slender, 2.5–6 cm. high, usually narrowly winged below the leaves, glabrous, reddish-purple (when dry). *Stolons* axillary, several from each stem, mostly from above its middle, filiform, up to 22 cm. long, purplish, glabrous. *Leaves* aggregated at the base and apex of the stem, scattered along the intervening space, oblong or elliptic-oblong or spatulate, obtuse or subacute, sessile, basal and median 4–8 mm. long, glabrous, the apical usually longer, up to 1.2 cm. long and 3–4 mm. wide, purplish and increasingly ciliate with short gland-tipped hairs as they ascend the stem. *Flowers* either one only terminating the stem or with a second terminating a short lateral shoot; pedicels 1.5–8 mm. long, that of the lateral the shorter, terete, purplish, bearing short purple-gland-tipped hairs. *Hypanthium* widely campanulate, 1.5 mm. long, sparingly glandular-hairy like the pedicel. *Sepals* 5, oblong to broadly triangular-ovate, obtuse, unequal, 2.5–3 mm. long, 1.5–2.8 mm. wide, dark green with narrow purplish margins, minutely ciliolate, the ciliola sometimes purple-gland-tipped, 3-nerved. *Petals* 5, broadly obovate, rounded, 3–3.2 mm. long, 2–2.6 mm. wide, 5-nerved, yellow. *Stamens* 10; filaments linear-ensiform, 1.8 mm. long; anthers subglobose, 1 mm. diam. *Ovary* broadly conical above the hypanthium, 2 mm. long; carpels free for about half that length; style very short. *Capsules* not seen.

Tibet-Bhutan frontier, Phari to Tsethanka, 4600 m., fls. July, *Gould* 2384.

Saxifraga tsangchanensis Franch. [Saxifragaceae] (Yunnan).

Tibet-Bhutan frontier, above Tsethanka, 4600 m., fls. July, *Gould* 2395.

In the tips of the leaves and of the sepals there is a single round gland sunk in the tissue of the upper surface. This is not mentioned in published descriptions. I have not seen the type, but these glands are present in specimens in the Kew Herbarium identified as this species.

Epilobium sikkimense Hausskn. [Onagraceae] (Sikkim).

Khambu, 4300 m., fls. July, *Gould* 2357.

Cavea tanguensensis (Drumm.) W. W. Sm. et J. Small [Compositae] (Sikkim).

Rama to Melong Gompa, 4600 m., fls. early July, *Gould* 2326 ; Melong Gompa, 4900–5200 m., *Gould* 2233.

Lactuca macrantha *C. B. Clarke* [Compositae] (Sikkim).

Gautsa to Yatung, 3700 m., fls. July, *Gould* 2417.

Saussurea gossypiphora *Don* [Compositae] (Garhwal to Sikkim).

Linji La, 5200 m., fls. early July, *Gould* 2297.

Primula atrodentata *W. W. Sm.* [Primulaceae] (Sikkim).

Rama to Dumpa Gompa, 4900 m., fls. end June, *Gould* 2248.

Primula capitata *Hook.* [Primulaceae] (Sikkim, Bhutan).

Khambu, 4300 m., fls. July, *Gould* 2354.

Primula concinna *Watt* [Primulaceae] (Sikkim).

Above Gautsa, 4000 m., fls. June, *Gould* 2113.

Primula elongata *Watt* [Primulaceae] (Sikkim).

Tatung to Lachung La, 3700 m., fls. early June, *Gould* 2051 ; East of Yatung, 3700 m., fls. June, *Gould* 2073.

Primula muscoides *Hook. f. ex Watt* [Primulaceae] (Sikkim).

Linji La, 5200 m., fls. early July, *Gould* 2282.

Primula obliqua *W. W. Sm.* [Primulaceae] (Sikkim).

East of Yatung, 3700 m., fls. June, *Gould* 2074.

Primula pusilla *Wall.* [Primulaceae] (Kumaon to Sikkim).

Linji La, 5200 m., fls. early July, *Gould* 2283.

Primula Roylei *Balf. f. et W. W. Sm.* [Primulaceae] (Nepal, Sikkim).

Yatung to Lachung La, 3700 m., fls. early June, *Gould* 2036, 2050 ; Yatung, 3200 m., fls. June, *Gould* 2067, 2069.

Primula sapphirina *Hook. f. et Thoms.* [Primulaceae] (Sikkim).

Above Gautsa, 4000 m., fls. June, *Gould* 2112.

Primula sikkimensis *Hook.* [Primulaceae] (Sikkim, W. China).

Yatung to Gautsa, 3550 m., fls. June, *Gould* 2099 ; Tuna to Khambu, 4900 m., fls. & frt. July, *Gould* 2339 ; Tremo La, 4750 m., fls. July, *Gould* 2376.

Primula tenuiloba (*Hook. f.*) *Pax* [Primulaceae] (Sikkim).

Linji La, 5200 m., fls. early July, *Gould* 2280.

Gentiana depressa *D. Don* [Gentianaceae] (Garhwal, Nepal, Sikkim).

Near Phari, 4450 m., fls. Sept., *Gould* 1631.

As practically no dimensions have been given in the published descriptions it is thought advisable to give them here: *Surculi* up to 10 cm. long, the leaves on them ovate, up to 5 mm. long. *Leaves* on flowering stems up to 1.7 cm. long and 1.2 cm. wide.

Calyx-tube 1-1.2 cm. long ; lobes 7.5-9 mm. long, 8.5-9.5 mm. wide, overlapping, margins shortly decurrent on the tube, keel decurrent. *Corolla-tube* 3 cm. long, 1.6 cm. wide at the mouth ; lobes 5 mm. long, 6 mm. wide ; folds about half as long. *Stamens* inserted 1-1.2 cm. above the base of the corolla-tube ; filaments 9-12 mm. long ; anthers 4 mm. long, versatile. *Stipe* of ovary 6-8 mm. long. *Ovary* 1-1.2 cm. long ; style 5.5-6.5 mm. long ; stigmas linear-lanceolate, 3.5 mm. long, puberulous on the upper half.

Swertia multicaulis *D. Don* [Gentianaceae] (Nepal, Sikkim).

Phari to Tremo La, 4600 m., fls. and frt. June, *Gould* 2166 ; Linji La, 5200 m., fls. early July, *Gould* 2304.

Chionocharis Hookeri (*C. B. Clarke*) *I. M. Johnst.* [Boraginaceae] (Sikkim).

Linji La, 5200 m., fls. early July, *Gould* 2284.

Pedicularis Bietii *Franch.* [Scrophulariaceae] (W. China).

Melong Gompa, 4900-5200 m., fls. early July, *Gould* 2241 ; Rama to Dumpa Gompa, 4900 m., fls. end June, *Gould* 2279.

Pedicularis Oederi *Vahl* [Scrophulariaceae] (Kashmir to Sikkim).

Phari to Tremo La, 4600 m., fls. June, *Gould* 2157,

Picrorhiza Kurrooa *Benih.* [Scrophulariaceae] (Kashmir to Sikkim).

Rhamme, 4600 m., frt. early July, *Gould* 2337.

Salix Lindleyana *Wall. ex Hook. f.* [Salicaceae] (Sikkim).

Phari to Tremo La, 4600 m., fls. June, *Gould* 2167.

Salix Serpyllum *Anderss.* [Salicaceae] (Sikkim).

Khambu, 4300 m., fls. July, *Gould* 2362.

Smilacina purpurea *Wall.* [Liliaceae] (Garhwal to Sikkim).

East of Yatung, 3700 m., fls. June, *Gould* 2180.

XXXIX—PLANTS NEW TO ASSAM: XIII.*

C. E. C. FISCHER.

Lobelia deleiensis *C. E. C. Fischer*, sp. nov. [Lobeliaceae] ; a *L. erecta* Hook. f. et Thoms. foliis acuminatis, inflorescentia haud racemosa, pedicellis elongatis, calycis segmentis linearibus multo longioribus differt. A *L. longipedicellata* C. E. C. Fischer foliorum nervis numerosioribus, calycis segmentis linearibus, antheris hispidis distat. A *L. Wardii* C. E. C. Fischer foliis majoribus ellipticis nervis numerosioribus, calycis segmentis multo longioribus, corolla breviori latiore distincta.

A lolling herbaceous plant up to 1 m. high, branched above, rootstock not seen ; branchlets fistular, sulcate, glabrous. *Leaves* elliptic or elliptic-lanceolate, caudate or caudate-acuminate, base

* Continued from K.B. 1940, 198.

tapering, 6.5–15 cm. long, 1.6–4 cm. wide, primary nerves 9–11 pairs, ultimate network small, margins crenate-denticulate, uppermost small but not bracteiform; petioles 4–10 mm. long. *Flowers* axillary, solitary; pedicels slender, 2–4 cm. long, curving. *Ovary* cupular, 4–6 mm. long. *Calyx-tube* very short; segments linear, slender, spreading, 1.6–2 cm. long. *Corolla* cream-coloured; 3 median lobes lanceolate, caudate, 8 mm. long, 2 lateral linear-ensiform, caudate, 1.2 cm. long. *Stamens* a little shorter; filaments glabrous; 3 upper anthers slightly hispid, 2 lower bearded at the tip. *Style* columnar, villous round the shortly 2-fid stigma. *Ripe fruit* not seen.

Delei Valley, 28° 21' N., 96° 37' E., 1850–2150 m., fls. July, *F. Kingdon Ward* 8460. "Forms clumps in open glades in the temperate rain forest."

Lobelia longipedicellata C. E. C. Fischer, sp. nov. [Lobeliaceae]; a *L. erecta* Hook. f. et Thoms. foliis glabris, inflorescentia haud racemosa, pedicellis elongatis, calycis segmentis multo longioribus, antheris glabris distat.

A herb up to 1 m. high; rootlets rather thick, tomentose; stem simple, fistular, striate, 5 mm. diam. *Leaves* (radical not present) narrowly lanceolate or oblanceolate, acuminate, the lowest sometimes rounded, base cuneate or tapering, 5–15 cm. long, 1.3–3.5 cm. wide, one or two basal and a few apical shorter than the rest, primary nerves 5–7 pairs, indistinct, forming a sharp angle with the midrib, much reticulated, glabrous, minutely translucent-dotted, margins glandular-denticulate; petioles very short, one or two basal up to 1 cm. long, semiamplexicaul. *Flowers* solitary, axillary, but absent from the uppermost leaves which do not become bracteiform; pedicels up to 8 cm. long, sigmoidally curved, usually bearing 2 caducous bracts near the base or above, but below the middle, linear, 2–15 mm. long. *Ovary* turbinate; 6–7 mm. long. *Calyx-tube* short; lobes 5, linear-lanceolate, obtuse or subacute, 1–3 cm. long, 3.5–5.5 mm. wide, margins often with a few small glandular teeth. *Corolla* 1.5–1.8 cm. long, dark magenta-purple, puberulous below; 3 median lobes subequal, lanceolate, acute, 7–8 mm. long, 2 lateral linear, 1.1 cm. long. *Stamens* 1.4 cm. long; filaments minutely ciliate; anthers glabrous. *Style* nearly as long as the stamens, stout, pubescent below the subacutely 2-fid stigma. *Capsule* subglobose, 8–9 mm. diam.

Delei Valley, 28° 21' N., 96° 37' E., 1850–2450 m., fls. & frt. July, *Ward* 8443. "On south-facing scarped bracken-clad slopes where it grows in clumps."

Lobelia Wardii C. E. C. Fischer, sp. nov. [Lobeliaceae]; a *L. erecta* Hook. f. et Thoms. foliis acuminatis, floribus haud racemosis, pedicellis multo longioribus, calycis segmentis linearibus distincta; a *L. longipedicellata* C. E. C. Fischer calycis segmentis brevioribus linearibus, corolla graciliore, antheris pilosis distat.

A perennial *herb* ; rootstock not seen ; shoots long, trailing or arching, fistular, puberulous upwards. *Leaves* lanceolate, acuminate or caudate-acuminate, base cuneate, sometimes inequilateral, 4–8 cm. long, 1–2 cm. wide, upper reduced but not bracteiform, primary nerves 5–6 pairs, ultimate network fine, hispidulous on the nerves above, paler and glabrescent below, margins denticulate ; petioles 4–8 mm. long. *Flowers* solitary, axillary ; pedicels slender, up to 3–7 cm. long. *Ovary* cupular, 4–6 mm. long. *Calyx* tube very shallow ; segments linear, 4–5.5 cm. long, usually recurved at the apex. *Corolla* pure violet, 2.2 cm. long ; 3 median lobes broadly ovate, apiculate, 6.5 mm. long, 5.5 mm. wide, pilose within, lateral lobes ensiform, acuminate, 1–1.2 cm. long. *Staminal column* glabrous ; anthers pubescent, the 2 lower bearded at the apex. *Style* columnar, shorter than the stamens, pubescent around the dome-shaped, 2-fid stigma. *Fruit* not seen.

Delei Valley, 28° 21' N., 96° 37' E., fls. July, Ward 8445. " On the edge of thickets in the undergrowth."

Cassiope Wardii Marq. [Ericaceae].

Previously known only from S.E. Tibet.

Delei Valley, 28° 21' N., 96° 37' E., 3400–3700 m., fls. early June, Ward 8285. " On an outcrop of granite rock along the bamboo-clad ridge, in moss. Erect undershrub ; fls. scarcely open, milk-white."

Clerodendrum lasiocephalum C. B. Clarke [Verbenaceae].

This species was described by Clarke (Fl. Brit. Ind. 4, 594) on a single sheet collected by Griffith in the Mishmi country. The specimen is in fruit and Clarke had not seen the plant in flower, consequently the description is brief and hardly adequate. Further specimens having been received at the Kew Herbarium a fuller description is thought to be desirable. Curiously enough two of these later collections were made by Clarke himself in May and July 1885, apparently after he had composed his account of the *Verbenaceae*, which was published in August of the same year. The following description has been compiled from all the sheets available, including 3 from Upper Burma which are not again referred to here.

A *shrub* up to 2 m. high ; flowering twigs (lower parts not seen) terete, at first brown-tomentose, becoming merely pubescent by fruiting time. *Leaves* from broadly elliptic-ovate with a rounded or cuneate base to broadly ovate-cordate with a nearly truncate to distinctly cordate base, acute or acuminate, 6–25 cm. long, 5–21 cm. wide, at first greyish-brown tomentose on both faces, later only pubescent, primary nerves 5–8 pairs, looped and joining close to the margins, with the midrib prominent below, margins shortly ciliate, from slightly sinuate to finely or coarsely and irregularly sharply-dentate ; petioles 2–15 cm. long, indumentum as of the leaves. *Panicle* sessile or on a stout peduncle up to 4 cm. long, up to 7 cm. across and as long, congested ; bracts narrowly elliptic-lanceolate

to oblanceolate, finely acuminate, shortly petioled, tomentose to pubescent, up to 3 cm. long; pedicels 5–12 mm. long. *Calyx* narrowly funnel-shaped, pubescent; tube 7.5–8 mm. long; lobes 5, ensiform, finely acuminate, 1–1.5 cm. long. *Corolla* narrowly cylindric, wider at the base, suddenly much expanded at the apex; tube 2.5–3 cm. long; lobes 4, broadly obovate, rounded, 9–10 mm. long, 7 mm. wide. *Stamens* 4, inserted above the middle of the corolla-tube, long exserted; filaments filiform, 3.5–4 cm. long; anthers linear, cells acute and divaricate at the base, 3–4 mm. long. *Disk* narrowly turbinate, 1.5 mm. long, 4-ribbed and very shortly 4-toothed, forming a pediment to the ovary. *Ovary* oblong, depressed, slightly compressed, 1.5–2 mm. long; style filiform, shortly exserted, apex acutely 2-fid. *Drupe* 6 mm. diam., red.

Mishmi, *Griffith* Kew Dist. No. 6055. Dupla, *Booth* (without no. or details). Khasia Hills, Nungpo, 460 m., fls. May, *C. B. Clarke* 38106A, "shrub 5 ft.; corolla white; bracts and head purple-red." Shillong, 1300 m., fls. July, *Clarke* 44144A. Naga Hills, Khonoma, 1540 m., fls. April, *N. L. Bor* 2724, "very foetid."

XL — NEW OR LITTLE-KNOWN PLANTS FROM SOUTHERN INDIA : XIII.*

Salacia Gambleana *M. M. Whiting et K. N. Kaul*, nom. nov. [Celastraceae].

Gamble gave the name *Salacia Talbotii* (K.B. 1916, 133) to a plant of North Kanara collected by W. A. Talbot in 1886 and 1888 (Anishi Ghat—nos. 1217 and 1361 in Herb. Kew.), overlooking E. G. Baker's *Salacia Talbotii* published in his Catalogue of Nigerian Plants 1913, p. 19, collected by P. A. Talbot, no. 1687. The North Kanara plant has therefore been re-named *Salacia Gambleana*.

Ruellia Beddomei *C. B. Clarke* [Acanthaceae].

This species has hitherto been found only in the Central Provinces of India.

Billigirirangan Hills, 4th mile on Punjur Ghat, 1150 m., fls. and frt. Sept., *E. Barnes* 2189, 2190. "Under the shade of bamboo on rocky slope. Corolla white."

Chlorophytum acaule *Baker* [Liliaceae].

This species was founded on a single sheet, holding 3 plants with capsules only, collected by Jerdon in the "East Indies" without precise location (see Journ. Linn. Soc. 15, 327). No further specimens being available when vol. VI of the Fl. Brit. Ind. was published, Hooker placed it (p. 336) among the "doubtful and imperfectly known species." Professor E. Barnes has now sent a specimen of this plant to Kew, collected in the Elagiri Hills of the North Arcot District at 1075 m., fruiting in Dec. (*E. Barnes* 2210).

* Continued from K.B. 1939, 662.

This plant also bears only capsules, but, fortunately, Prof. Barnes has plants growing at Tambaram and has seen flowers though somewhat imperfect ones. A fuller description has therefore been drawn up from these two collections and from Prof. Barnes's notes to replace the incomplete published descriptions.

A stemless *herb* ; root-fibres slender, puberulous, up to 16 cm. long (not including the tuber), mostly (all?) bearing a cylindric tuber up to 3 cm. long by 5 mm. diam., near its apex. (These tubers are not mentioned by Baker and Hooker though one plant on Jerdon's sheet exhibits 3 of them.). *Leaves* linear, up to 49 cm. long and 1 cm. wide (on the Jerdon sheet). *Flowers* few, 1-3 together in the axils below ground level, developing one at a time ; pedicels slender, inarticulate, up to 5 cm. long in fruit. In addition 2 of Jerdon's plants bear what appear to be 2 or 3 slender scapes up to 11 cm. long, but devoid of flower or fruit, and one of these shows a short lateral branch (pedicel?). Barnes notes that the flowers are deep in the axils underground, so probably the pedicels lengthen after flowering to push the capsule above ground. *Tepals* very narrow, concave, white or colourless, with 5 very close nerves forming a median channel, margins narrowly membranous. *Stamens* in the groove of the tepals ; filaments very slender, 4 mm. long ; anthers yellow, 2-celled, 5 mm. long. *Style* 1.5 mm. long, stigma reddish. *Capsules* oblong, obtuse, slightly emarginate, 7-9 mm. long ; seeds 4-5 in each cell, 2.5-3 mm. diam., black, shining, minutely muriculate.

Professor Barnes thinks that the flowers may be cleistogamous ; this is very probable, but it is also possible that they may be fertilised by crawling insects.

Dipcadi madrasicum *E. Barnes et C. E. C. Fischer*, sp. nov. [Liliaceae] ; *D. montano* (Dalz.) Baker peraffinis, scapo folisque longioribus, tepalis apice haud glandulosis, antheris filamentis multo brevioribus distinctum.

A scapigerous *herb* ; bulb spherical to conical, up to 2.5 cm. diam., axis yellow, inner coats white, outer buff and membranous at first, later dark- or greyish-brown and loosely fitting ; rootlets fibrous, white. *Leaves* few, radical, under dry conditions more or less terete, narrowly channelled above, 10-15 cm. long, 2-3 mm. diam., in moister localities linear, more or less flat with involute margins, tapering to a slender conical tip, narrowed to a tubular base, up to 33 cm. long and 5.5 cm. wide, subglossy, darkish-green upwards, brownish-red at ground level and white below ground. *Scape* erect, terete, smooth, glaucous green with a waxy lustre, usually longer than the leaves, up to 75 cm. long, 7-12-flowered, flowers pendent ; bracts broadly ovate with a claw-like acuminate tip, base slightly auricled, lower margin erose or irregularly denticulate, greenish and membranous in bud, in flower brown and shrivelled, longer than the rather stout, curved, green, 3-5 mm. long pedicels. *Perianth* narrowly campanulate, 1-1.15 cm. long ; the 3 outer tepals oblong,

attached for $\frac{1}{3}$ — $\frac{1}{2}$ their length, pale-green, upper half reflexed, apex bluntly triangular with a thickened tip and a tuft of hairs within, eglandular; inner tepals slightly shorter, erect, yellowish-green with a thickened greenish rib, tip directed outwards with or without a tuft of hairs. *Stamens* attached to the upper part of the perianth-tube; filaments linear-ensiform, 4–5 mm. long; anthers linear, 2.7–3 mm. long, dorsifixed; pollen-grains ovoid, subacute at both ends, longitudinally grooved, 1 mm. long, 0.5 mm. wide. *Ovary* shortly stipitate, ellipsoid to obovate-ellipsoid, 4–5 mm. long; style stout, terete, 3–3.5 mm. long; stigma subglobose, obscurely 6-lobed. *Capsules* erect, straw-coloured, oblate, deeply 3-lobed, lobes spreading, vertically compressed, 7 mm. long, 1.2 cm. wide, margins irregularly thickened. *Seeds* numerous, irregularly discoid, thin, 5 mm. diam., black, subglossy, surfaces papillose, margins often thickened.

Chingleput District: Tambaram, 70 m., fls. Nov., *E. Barnes* 1801 (type in Kew Herb.), 2085. Also at Guduvancheri. Common in both localities in dry stream-beds and other sandy and marshy places in scrub jungle, flowering and fruiting Sept. to Nov. Tamil name *Katuwengaim*, a name which appears to be applied also to other bulbous plants; the bulb is eaten in times of scarcity.

XLI—CONTRIBUTIONS TO THE FLORA OF TROPICAL AMERICA: XLIV.* FURTHER NOTES ON TROPICAL AMERICAN BIGNONIACEAE. N. Y. SANDWITH.

Phryganocydia phellosperma (Hemsl.) Sandwith, comb. nov.—*Macfadyena phellosperma* Hemsl. in Biol. Centr. Amer. Bot. ii. 492 (1882).

PANAMA CANAL ZONE. Swamp, Rio Grande, June 1861, *Sutton Hayes* 81 (type in Herb. Kew.). Near Balboa, behind mangrove swamp, June 1939, *A. H. G. Alston* 8830 (Herb. Mus. Brit., Herb. Kew.); flowers pale purple with darker spot on lip.

No reference was made to this very distinct plant by Standley in his *Flora of the Panama Canal Zone* (1928), and it has apparently awaited rediscovery until last year when Mr. Alston collected flowering material agreeing with the type and growing in a similar habitat. The peculiar character of the calyx, the simple tendril, flower-colour and other characters leave no doubt of the generic relationship of the species, and it is surprising that the necessary combination has not been made sooner. Apart from the very remarkable characters of the fruit—short and ovoid, with thick and corky, almost wingless seeds—which so little resembles the linear capsule and transversely oblong thin seeds with broad membranous wings of *P. corymbosa* (Vent.) Bur. ex K. Schum., *P. phellosperma* also differs from its ally in the more conspicuously and narrowly cuspidate apex of the leaflets which are more intricately

* Continued from K.B. 1939, 563.

reticulate beneath, and in the strongly pilose anterior side of the corolla within the tube above the insertion of the filaments. The calyx, moreover, appears to be more broadly and shortly horned.

The following note written by Sutton Hayes on the sheet bearing the fruit in the Kew Herbarium is of interest: "This is the fruit of no. 81, which was named *Spathodea corymbosa* Vent. but, if *Macfadyena corymbosa* of Grisebach's Flora is the same, my plant must be wrongly named, for the capsule is very different. My plant is found in swamps near Panama, and I never have seen it growing on high land, but my no. 222 named *Macfadyena corymbosa* Griseb. [this is correctly referred to *Phryganocydia corymbosa*] is always found on high land and never in swamps. The fruit of this plant [no. 81] is thick and fleshy like that of many other plants peculiar to swampy places." One may add the observation that parallel instances occur in *Bignoniaceae*, for instance in the genus *Tabebuia*, one species of which occurring on river-banks produces short capsules with corky more or less wingless seeds adapted for water-borne distribution.

Several perplexing collections of *Schlegelia* from Central and S. America have recently occupied the writer's attention. All of them resemble each other closely in general characters of the inflorescence, and are allied to the Brazilian *S. Ramizii*, a species of the section *Paratanaecium* with small white flowers. They differ from it, and most of them from each other, in small details which the writer prefers to treat as of varietal significance until there is far more evidence to the contrary. The following three varieties are therefore provisionally proposed:

Schlegelia (§ *Paratanaecium*) **Ramizii** Sandwith var. **macrandra** Sandwith, var. nov.; a typo inflorescentiis glabrescentibus, corollae lobis majoribus ad 7.5 mm. longis, filamentis longioribus circiter 5 mm. longis glabris basi tantum breviter piloso-papillois, antheris exsertis differt.

AMAZONIAN PERU. Dept. Loreto; Florida, Rio Putumayo, at mouth of Rio Zubinata, c. 180 m., in forest, fl. May-July 1931, *Klug* 2191; *ibid.*, fl. Oct.-Dec. 1931, *Klug* 2340 (typus). "Flowers white."

COSTA RICA. Vara Blanca de Sarapiquí, north slope of Central Cordillera, 1500-1750 m., fl. July-Sept. 1937, *Skutch* 3324. This collection has somewhat smaller corolla lobes and the filaments vary in length from 3-5 mm. "Flowers white."

S. Ramizii Sandwith var. **costaricensis** Sandwith, var. nov.; a typo foliis majoribus ad 14 cm. latis, inflorescentiis dense furfuraceo-puberulis (haud pilosulis), filamentis longioribus 3 mm. longis basi albo-villosis ceterum glabris differt.

COSTA RICA. Prov. San José; El General, 700 m., fl. Feb. 1939, *Skutch* 4125 (typus). "Flowers white."

The following Colombian collections agree with this variety in characters of the leaves and stamens but differ in the pilosulous inflorescence :

COLOMBIA. State of Boyacá : Caviche region, 140 m. N. of Bogotá, in high forest, 1300 m., April 1933, *Lawrance* 756 ; El Humbo region, 130 m. N. of Bogotá, in high forest, 1300 m., May 1933, *Lawrance* 803. The corolla lobes of both these collections were noted as white, tinted at the base with purple or maroon.

S. Ramizii *Sandwith* var. **trichandra** *Sandwith*, var. nov. ; a typo inflorescentiis dense furfuraceo-puberulis (ut in var. *costari-censi*), filamentis ut in typo brevissimis 1.2 mm. longis sed per totam longitudinem dense albo-villosis, staminodio etiam praesertim apicem versus albo-villoso differt.

BRITISH HONDURAS. Ann. 1906-7, *Peck* 666 (typus).

XLII.—STUDIES IN THE ERICALES: III.* A NEW SPECIES OF GAULTHERIA FROM THE MALAY PENINSULA. H. K. AIRY-SHAW.

Gaultheria malayana *Airy-Shaw*, sp. nov. ; ab affini *G. punctata* Bl. ramis subteretibus nec angulato-alatis, foliis crassioribus rigidioribus plerumque latioribus brevioribusque, bracteis sepalisque minoribus minus acuminatis facile distinguenda.—*G. fragrantissima* Wall. *sec.* Ridley in Journ. F.M.S. Mus. **6**, 49 (1915) et Fl. Mal. Penins. **2**, 212 (1923), *non* Wall. ; cf. J. J. Smith in Koord. et Val. Bijdr. Booms. Java **13** (Meded. Dep. Landb. **18**), 123 (1914), in obs.

Frutex vel *arbuscula*, statura ignota. *Rami* teretes vel obscurissime angulati, 2-3 mm. crassi, subrecti, glabri vel juniores minutissime papilloso-puberuli. *Folia* elliptica (rarius suboblonga) usque latissime suborbiculari-elliptica, 3.5-6.5 cm. longa, 1.5-4.7 cm. lata, apicem rami versus valde decrescentia, minima 1 cm. longa et 3 mm. lata, basi in maximis latissime subcuneata in mediocribus rotundata, apice rotundata vel obtusa, minute sed distinctissime (1 mm.) cuspidata, margine crebre subcrenato-serrulata, basin versus subintegra, crasse et rigide coriacea, utrinque glabra sed supra sparse subtus dense cicatricibus foveoliformibus brunneis setularum delapsarum conspicue punctata, folia juniora minima subtus setulis brevibus brunneis dense conspersa et setuloso-ciliata, siccitate supra brunneo-olivacea, subtus castanea ; costa supra leviter impressa, subtus modice elevata, glabra ; nervi laterales 5-7-jugi, immersi, subtus inconspicue prominuli, patuli, primum recti, deinde marginem versus arcuato-anastomosantes, reticulationibus laxis subtus valde obscuris ; petioli usque 1 cm. longi, supra subplani, sulcati, subtus teretes, glabri. *Racemi* axillares vel in paniculam terminalem fere aphyllam dispositi, 2.5-5.5 cm. longi, graciles,

* Continued from K.B. 1935, 156.

suberecti usque patuli, rarius patentés, 10–16-flori, minute puberuli. *Bracteae* minutae, ovatae, 1 usque vix 2 mm. longae, patentés, ciliolatae, ceterum glabrae, persistentes. *Pedicelli* graciles, patentés vel deflexi, 4–5 mm. longi, minute puberuli. *Bracteolae* binae, oppositae, imo apice pedicelli sitae, late ovatae, 1 mm. longae, ciliolatae, ceterum glabrae, persistentes. *Calyx* late cupularis, 4–5 mm. latus, 2–3 mm. longus, extra glaber, intus breviter pubescens, segmentis 5 ovatis 1–1.5 mm. longis acute cuspidatis minute ciliolatis. *Corolla* ovoideo-urceolata, circiter 4 mm. longa et 3 mm. lata, rosea et alba (teste Symington), lobis 5 late deltoideo-ovatis 1 mm. longis revolutis margine minute eroso-denticulatis. *Stamina* 10, fere 2.5 mm. longa: filamenta plana, obovata, 1 mm. longa, superne in connectivum abrupte attenuata, dense papillosa, longiuscule ciliolata; antherae oblongo-ovoideae, 1 mm. longae, thecis in caudas 2 graciles reflexas fere 1 mm. longas desinentibus. *Disci glandulae* staminibus alternantes, anguste triangulares, 0.5 mm. longae, ovario adpressae. *Ovarium* late depresso-ovoideum, 1.5 mm. longum, 2 mm. diametro, pubescens; stylus 1.8 mm. longus, inferne puberulus, superne glaber. *Capsula* in calyce nigro carnosio 4–5 mm. longo inclusa, 2–3 mm. longa, pubescens, pedicello usque 6–7 mm. elongato. *Semina* numerosa, irregulariter ovoidea, 0.5 mm. longa, reticulata, laete castanea.

PERAK. Gunong Korbu, 1800 m., Feb.–March 1913, *H. C. Robinson's Dyak Collectors* (typus, Herb. Kew.); *ibid.*, ridges above 1650 m., 22 July 1933, Symington 32117 (Kep.): "shrub or treelet; flowers pink and white;" C. H. Gunong Terbakar, summit, 12 Apr. 1934, Symington 36233 (Kep.); C. H. Gunong Batu Brinchang, 14 Apr. 1934, *Ja'amat & Yalip* 36505 (Kep.).

Dr. J. J. Smith (l.c.) regarded this plant as combining the inflorescence characters of *Gaultheria fragrantissima* Wall. and *G. punctata* Bl., since the racemes are both axillary (as in the former) and terminally paniced (as in the latter). But, while this is true so far as it goes, the subterete stems and thick rigidly coriaceous leaves of the Perak plant are very different from those of the Himalayan and of the Sumatran-Javanese species. The leaves are also shorter and broader than either, in their common forms, but I have not seen Miquel's *G. punctata* var. β 'foliis multo minoribus ovatis vel ellipticis,' based on a Korthals specimen from Mt. Papandayang, Java (Ann. Mus. Bot. Lugd. Bat. 1, 41: 1863). Provisionally, therefore, at least, I regard these as three distinct species.

I am indebted to Mr. C. F. Symington for the loan of material from the herbarium of the Forest Research Institute, Kepong, F.M.S. (indicated above by the abbreviation Kep.).

XLIII—STUDIES IN THE ERICALES: IV.*

CLASSIFICATION OF THE ASIATIC SPECIES OF GAULTHERIA. H. K. AIRY-SHAW.

The subdivision of the genus *Gaultheria* into natural groups has never been seriously undertaken. G. Don (Gen. Syst. 3, 839: 1834) seems to have been the first to deal with all the species known in his day; these numbered 29. He made only two divisions: "Flowers axillary, solitary. Peduncles or pedicels beset with some imbricated bracteas at the base;" and, "Racemes axillary and terminal at the tops of the branches. Pedicels bibracteate." He included *G. procumbens* L., the type species of the genus, in the first division, though actually it would require a separate division ("Flowers axillary, solitary. Pedicels bibracte[ol]ate.").

A. P. de Candolle (Prodr. 7 (2), 592: 1869) enumerated 43 species, of which five were "non satis notae." The remaining 38 were arranged in three groups: "Pedicellis axillaribus 1-floris solitariis bibracteolatis, bracteolis immediatè sub flore sitis;" "Pedicellis axillaribus 1-floris solitariis bibracteolatis, bracteolis à flore remotis;" and, "Floribus racemosis, bracteis amplis sicco-membranaceis, bracteolis in medio aut basi pedicelli." The first of these groups, in which he placed all the known Asiatic species, was surprisingly heterogeneous. Although *G. procumbens* L. and *G. trichophylla* Royle were correctly included therein, with them were associated *G. Myrsinites* Hook. (i.e. *G. humifusa* [Grah.] Rydb.), *G. Nummulariae* DC. (i.e. *G. nummularioides* D. Don) and *G. repens* Bl., in none of which are the pedicels bibracteolate nor are the bracteoles immediately beneath the flower; and even more remarkable was the inclusion of the racemose-flowered *G. fragrantissima* Wall., *G. Leschenaultii* DC., *G. punctata* Bl. and *G. leucocarpa* Bl., in defiance of de Candolle's definition of the group.

C. B. Clarke's treatment of the Indian species (Fl. Brit. Ind. 3, 456: 1882) added little to the knowledge of the genus. *G. nummularioides* and *G. trichophylla* were separated from the remainder on account of their procumbent habit and solitary flowers, whilst *G. discolor* Nutt. and *G. semi-infera* (C. B. Cl.)† were placed (the latter provisionally) in the genus *Diplycosia*.

A tentative arrangement of the Malayan species was published by H. F. Copeland in the third of his series of papers on Philippine *Ericaceae* (Philipp. Journ. Sci. 47, 57-63: 1931)—incidentally a valuable and suggestive contribution to the study of the whole family. (Copeland's arrangement is adopted by van Steenis in Bull. Jard. Bot. Buitenz. sér. 3, 13, 204: 1934.) He recognizes three groups of species, designated as allies of *Gaultheria nummularioides*, of *G. fragrantissima*, and of *G. leucocarpa*, respectively. The second and third groups are undoubtedly natural; the first,

* Continued from previous page.

† *Gaultheria semi-infera* (C. B. Cl.) Airy-Shaw, comb. nov.—*Diplycosia? semi-infera* C. B. Clarke in Hook. fil. Fl. Brit. Ind. 3, 459 (1882).

however, is unfortunately heterogeneous and involves some definitely erroneous statements. Thus, in the key to the species (*l.c.*, p. 58), *G. nummularioides* is stated to have "a definite pair of bracteoles immediately below the calyx": this is true of *G. trichophylla* Royle (included by Copeland in this group) and its allies, but *not* of *G. nummularioides*. In fact, none of the other species, mentioned by Copeland as "allies" of the latter, are such in reality.* It is clear, therefore, that this group, characterized by "leaves generally under 2 cm. long" (*l.c.*, p. 57), is a purely artificial one.

The Asiatic species of *Gaultheria* can be arranged in natural groups by the use of the following characters:

- A. Leaves broadest below or above middle (\pm ovate or \pm obovate).
- B. Inflorescence perulate or eperulate at base.
- C. Flowers racemose or solitary.
- D. Pedicels bibracteolate at base, middle or apex, or bracteoles several, scattered.
- E. Corolla capanulate or urceolate.

By taking these characters in various combinations, it is possible to establish five major groups of species. It must be clearly stated that the groups here proposed are based solely upon the species of continental and insular Asia (together with four from North America whose affinities are evidently Asiatic). No attempt has been made to correlate with them the numerous Australasian and Central and South American species†, on which other workers both in this country and in America are already engaged. It is hoped, however, that the arrangement here sketched may suggest a basis upon which a satisfactory natural classification of the whole genus may ultimately be founded. The shape and nervation of the leaves, and the structure of the inflorescence, appear to give the best characters for groups, the position and number of the bracteoles being particularly important.

CONSPECTUS SECTIONUM ET SERIERUM.

Sect. i. **Brossaeopsis**, sect. nov. Pedicelli ima basi bibracteolati, bracteolis suboppositis; folia infra medium latiora (plus minus ovata); nervi praecipui pauci (utrinque 1-3), basales vel sub-basales (nervatio "melastomacea").

Series 1. **DUMICOLAE** *Airy-Shaw* in Hook. Ic. Plant. **33**, sub t. 3207 (1933). Flores in racemos breves subcorymbosos basi perulatos dispositi; corolla campanulata, intus glabra; filamenta glabra; ovarium glabrum vel pilosum.—Typus: *G. dumicola* W. W. Sm.

Series 2. **ATJEHENSES**, ser. nov. Flores in racemos breves subcorymbosos basi pauciperulatos dispositi; corolla urceolata, intus puberula; filamenta longe pilosa; ovarium pilosum.—Species unica: *G. atjehensis* J. J. Sm.

* *G. mundula* F. Muell., *G. novaguineënsis* J. J. Sm., *G. borneënsis* Stapf and *G. benguetensis* Copel. are "allies of *G. fragrantissima*."

† Compare, however, the remarks on p. 310, below, on Sect. *Brossaeopsis*.

Series 3. NUMMULARIOIDEAE, ser. nov. Flores solitarii; bracteae et bracteolae similes, complures, stramineo-submembranaeae; corolla campanulata usque urceolata, intus pilosa; filamenta margine pilosa; ovarium glabrum. Suffrutices prostrati, longe repentes.—Species unica: *G. nummularioides* D. Don.

Sect. ii. **Amblyandra**, sect. nov. Pedicelli pluribracteolati, bracteolis sparsis alternis; folia infra medium latiora (plus minus ovata), penninervia usque subquintuplinervia; flores solitarii (raro in pseudo-racemos terminales, ut videtur, dispositi); corolla campanulata, intus glabra; filamenta glabra; antherae exaristatae. Suffrutices parvi, saepe repentes.—Typus: *G. humifusa* (Grah.) Rydb.

Sect. iii. **Leucothoides**, sect. nov. Pedicelli prope basin, medium vel apicem bibracteolati, bracteolis alternis vel suboppositis; folia plerumque supra medium latiora (plus minus obovata), penninervia; flores in racemos basi perulatos plerumque adscendentes dispositi, interdum tetrameri; corolla plerumque manifeste urceolata.—Typus: *G. fragrantissima* Wall.

Sect. iv. **Eugaultheria**, sect. nov. Pedicelli imo apice bibracteolati, bracteolis oppositis; flores solitarii; folia plerumque parva, penninervia.—Typus: *G. procumbens* L.

Series PROCUMBENTES, ser. nov. Flores pentameri; corolla suburceolata, intus cum filamentis dense villosa; ovarium omnino superum; folia majuscula, usque 6 cm. longa et 1–3 cm. lata; pedicelli usque 1 cm. longi. Suffrutex repens, ramis erectis apicem versus paucifoliatis.—Species unica: *G. procumbens* L.

Series TRICHOPHYLLAE, ser. nov. Flores pentameri; corolla campanulata, raro urceolata, intus cum filamentis glabra; ovarium omnino superum; folia minuscula, usque 1.7 cm. longa et 0.8 cm. lata; pedicelli 2–4 (raro 5–10) mm. longi. Suffrutices humiles, caespitosi, ramulis erectis vel subprostratis dense foliatis.—Typus: *G. trichophylla* Royle.

Series HISPIDULAE, ser. nov. Flores tetrameri; corolla brevissime campanulata, intus cum filamentis glabra; ovarium spurie semi-inferum; folia parva, brevissime ovata usque obovata; pedicelli brevissimi. Suffrutices omnino prostrati, ramulis gracillimis longe repentibus distiche foliosis.—Typus: *G. hispidula* (L.) Muhlenb.

Sect. v. **Gymnobotrys**, sect. nov. Pedicelli imo apice bibracteolati, bracteolis oppositis; flores racemosi; racemi basi eperulati; folia infra medium latiora (ovata usque lanceolata); flores in racemos axillares saepe deflexos vel in racemos vel paniculas terminales dispositi; corolla plerumque campanulata.—Typus: *G. leucocarpa* Blume.

ARTIFICIAL KEY TO THE SECTIONS AND SERIES.

Flowers solitary; dwarf undershrubs with mostly small leaves:

Bracteoles 2, opposite, immediately beneath the calyx.....

Eugaultheria

- Leaves over 1 cm. wide ; filaments and inside of corolla hairyPROCUMBENTES
- Leaves less than 1 cm. wide ; filaments and corolla glabrous :
 Flowers pentamerous ; plants more or less caespitose.....
 TRICHOPHYLLAE
- Flowers tetramerous ; plants very slender, quite prostrate
 HISPIDULAE
- Bracteoles (bracts) several, alternate, not immediately beneath the calyx :
 Corolla pilose within ; filaments pilose on the margin ; anthers 4-aristate ; fruiting calyx blue.....
- Brossaeopsis**—NUMMULARIOIDEAE
- Corolla glabrous within ; filaments glabrous ; anthers exaristate ; fruiting calyx scarlet.....**Amblyandra**
- Flowers racemose or paniculate ; bracteoles 2 ; shrubs with mostly broad leaves :
 Inflorescence eperulate ; bracteoles opposite, immediately beneath the calyx.....**Gymnobotrys**
- Inflorescence perulate :
 Bracteoles alternate or subopposite, at about middle of pedicel (more rarely near base or apex) ; pedicels much shorter than axis of inflorescence ; corolla urceolate (very rarely campanulate) ; leaves mostly obovate or oblanceolate
 Leucothoides
- Bracteoles subopposite, at extreme base of pedicel ; pedicels as long as axis of inflorescence, or nearly so :
 Corolla campanulate, glabrous within ; filaments glabrous
 Brossaeopsis—DUMICOLAE
- Corolla urceolate, puberulous within ; filaments long-pilose
 Brossaeopsis—ATJEHENSES

Of these groups, Sect. *Leucothoides* corresponds to Copeland's second group, "allies of *G. fragrantissima*," Sect. *Gymnobotrys* to his third group, "allies of *G. leucocarpa*," and Series *Nummularioideae*, of course, to his first group, "allies of *G. nummularioides*." Sect. *Eugaultheria* would also be included in his first group, in so far as he includes in the latter *G. trichophylla* Royle. Series *Dumicolae* and *Atjehenses* and Sect. *Amblyandra* are not accounted for in his arrangement, no Malayan species being then known ; the Japanese *G. adenothrix* (Miq.) Maxim. is not mentioned by him.

In the present paper, only Sections *Brossaeopsis*, *Amblyandra* and *Eugaultheria* are dealt with in detail. It is hoped to treat the remaining Sections *Leucothoides* and *Gymnobotrys* in a future paper in this series. Their general characteristics are, however, outlined below in their appropriate places (pp. 316, 329).

Section i. **Brossaeopsis.**

A group of very distinct species, the only ones in the Old World in which the bracteoles are situated at the extreme base of the

pedicel, more or less enclosed by the bract. The short axis of the racemes and the proportionately rather long pedicels give the inflorescences a fasciculate appearance.

The species occur in two distinct geographical areas. The more northerly one includes practically the whole range of the Himalaya and the mountains of south-west China. *G. nummularioides* covers the whole of this region, and three isolated species occur in the eastern part. The more southerly area includes Java and Sumatra, where *G. nummularioides* again occurs, in the mountains, whilst two isolated species, clearly related to the other three, are known from the mountains of Sumatra.

These facts of distribution would seem to indicate an ancient type, in the past probably occurring over a wide area and represented by numerous species, but now limited to a few species on the verge of extinction in their few remaining localities.

A large group of American species of *Gaultheria*, including the well-known *G. Shallon* Pursh, are closely related to the Asiatic section now represented by these few relicts. This is especially true of the West Indian species, *G. cordifolia* (Sw.) Raeusch. (*Brossaea coccinea* L.; *Gaultheria coccinea* (L.) Urb. [1902], non H. B. K. [1819]) and *G. domingensis* Urb., in which the inflorescence is much contracted. The name *Brossaeopsis* has accordingly been adopted for the present group. The American species agree in leaf-shape and to a less extent in nervation, and the bracteoles are well below the middle of the pedicel. In the majority of the American group the bracts tend to be developed at the expense of the bracteoles, but in the two West Indies species they are more equal. The chaffy texture of these organs in *G. nummularioides* is very similar to that of many of the American species, except that in the latter they are usually conspicuously parallel-veined. Whereas, however, in Sect. *Brossaeopsis* the corolla is usually widely campanulate, in *Brossaea* it is definitely urceolate, showing in this respect an advance on the more primitive Asiatic group.

Series i. DUMICOLAE.

The four species of this series represent the most primitive type of *Gaultheria* surviving in the Old World. This is suggested both by the basal position of the bracteoles and also by the type of geographical distribution outlined above. The short, congested racemes, the campanulate corollas, the leaf-shape and peculiarly characteristic nervation and also (except in *G. dumicola*) the indumentum, call to mind certain species of *Diplycosia*, from which circumstance it might plausibly be inferred that that genus and the *Dumicolae* originated from a common, not far distant stock. The truly racemose inflorescence, however, the position of the bracteoles and the structure of the anthers exhibit a wide divergence from *Diplycosia*, a specialised and essentially uniform type, which must

have arisen very anciently, since no direct connecting links with *Gaultheria* now remain.

The inflorescence is comparable with that found in the American sections *Eulyonia* Rehd. and *Maria* Rehd., of the genus *Lyonia* Nutt. (non Ellis), and carried to its extreme state—the fascicle—in *Zenobia*, to the flowers of which those of *Gaultheria codonantha* Airy-Shaw (*vide infra*) bear a considerable resemblance. This resemblance is not confined to the superficial structure of the inflorescence, but is enhanced by close agreement in the morphology of the calyx, corolla, filaments, anthers and seeds, and perhaps indicates a closer relationship between these three genera than has hitherto been suspected.

CLAVIS SPECIERUM.

- Folia parva, usque 3·5 cm. longa ; ramuli graciles, usque 1 mm. crassi ; corolla circiter 5 mm. longa ; ovarium glabrum (Yunnan).....4. *notabilis*
 Folia majora, 5–15 cm. longa ; ramuli robusti, 1–5 mm. crassi : Rami et folia glaberrima ; corolla circiter 5 mm. longa ; stamina plerumque valde redacta, antheris saepe deficientibus ; ovarium pilosum (Yunnan).....3. *dumicola*
 Rami et folia (saltem subtus) setosa vel hispido-pubescentia : Folia plana, usque 15 cm. longa ; corolla circiter 15 mm. longa ; ovarium glabrum (Assam).....1. *codonantha*
 Folia plana, usque 10 cm. longa ; corolla circiter 5 mm. longa ; ovarium pilosum (Burma super.)...3. *dumicola* var. *aspera*
 Folia matura valde bullata, usque 7·5 cm. longa ; corolla circiter 5 mm. longa ; ovarium pilosum (Sumatra).....2. *abbreviata*

1. **G. codonantha** *Airy-Shaw* in Hook. Ic. Plant. **33**, t. 3207 (1933); Journ. Roy. Hort. Soc. **59**, 305, Proc. p. cxxxi (1934) ; Bot. Mag. **159**, t. 9456 (1936).

Gaultheria sp., Gard. Chron. **94**, 424, 428 (fig. 182), 445 (1933).

G. codonantha may probably be regarded as the nearest known species to the prototype of the genus, for, apart from the contraction of the inflorescence-axis, it exhibits very little specialisation in any direction by comparison with its congeners. Whereas the majority of the species are adapted to life at considerable altitudes, *G. codonantha* occurs at an elevation of only 1,500 metres in Assam. The unrestrained development of all parts—leaves, flowers and general habit—suggests a relatively primitive species with little or no adaptation to special conditions.

2. **G. abbreviata** *J. J. Sm.* in Fedde, Rep. Spec. Nov. **35**, 292 (1934) ; van Steenis in Bull. Jard. Bot. Buitenz. ser. **3**, **13**, 204 (1934).

Additional record :

SUMATRA. Resid. Padangsche Bovenlanden : Gunong Singgalan, 2100 m., 16 Jan. 1913, *C. G. Matthew* sine numero (Herb. Kew.).

The occurrence of a member of this otherwise East-Himalayan group as an outlier in the Malay archipelago is interesting and rather unexpected. In its robust habit and large bracteate inflorescences it is somewhat reminiscent of *Diplycosia sumatrensis* Merrill, also collected on Mt. Singgalan by Beccari (no. 328). The older leaves are remarkable for the bullate elevation of the tissue between the principal nerves. It may be noted that *G. abbreviata*, though the latest of this group to be described, was actually the first to be discovered, for Beccari's specimens (cited by J. J. Smith, *l.c.*; duplicate in Herb. Kew.) were obtained as long ago as 1878.

3. *G. dumicola* W. W. Sm. in Notes Roy. Bot. Gard. Edinb. **9**, 106 (1916).

G. dumicola was first collected by Forrest in May, 1912. The specimen, however, bore only old fruit. C. K. Schneider next obtained it in October, 1914 (*Schneider* 2561, Herb. Kew.). It was again gathered by Forrest on several occasions during later expeditions. All these collections came from the immediate neighbourhood of Tengyueh ($25^{\circ}15'$ to $25^{\circ}20'N.$) (the only known locality for *G. notabilis* also), at elevations of from 1800 to 2100 metres, where Forrest noted it as sometimes forming bushes 8-10 feet in height.

A greater contrast in allied species could scarcely be imagined than that obtaining between the diminutive, dingy flowers of *G. dumicola*, with its reduced androecium, and the large, handsome, white bells of *G. codonantha*, fully developed in all parts. It is evident that there are vast *lacunae* in this group, from consideration both of the morphology of its surviving representatives and also of their geographical distribution.

var. *petanoneuron* Airy-Shaw in Hook. Ic. Plant. **33**, t. 3206 (1933).

Gaultheria dumicola Auctt. Edin. in Notes Roy. Bot. Gard. Edinb. **17**, 158, 286, 360 (1930).

The variety *petanoneuron* was found by Forrest somewhat further north ($25^{\circ}30'$ to $26^{\circ}N.$) and at somewhat greater altitudes (2400-3000 metres) than the species, on the high divides on either side of the Salwin river.

var. *aspera* Airy-Shaw, var. nov., a typo foliis subtus brevissime et sparsiuscule subhispido-pubescentibus distincta.

UPPER BURMA. Adung valley, 1800 m., 17 Feb. 1931, *F. Kingdon Ward* 9425 (Herb. Mus. Brit.): "A shrub, common in thickets. Leaves coriaceous, harsh. Berries with bluish-white bloom."

The discovery of this pubescent-leaved plant brings *G. dumicola* more into line with the remaining species of the series, all of which have more or less stiffly pubescent foliage.

4. *G. notabilis* Anth. in Notes Roy. Bot. Gard. Edinb. **18**, 18 (1933), descr. hic amplif.

Suffrutex a basi ramosus, 0.3-0.4 m. altus. *Caules* erecti vel arcuato-ascendentes, circiter 1 mm. crassi, teretes, subtiliter striati, longe (maxime juniores) ferrugineo-setosi, internodiis circiter 1-1.5 cm. longis. *Folia* plerumque ovata, rarius oblongo-vel elliptico-ovata usque latissime ovata, usque 3.5 cm. longa et 2 cm. lata, basi rotundata vel subtruncata (juniora leviter angustata), apice brevissime et abrupte callosio-apiculata vel -cuspidata, margine subintegra vel obscurissime serrulata, longe ciliata, supra glabra, olivacea, subtus (maxime secus nervos) sparse setulosa vel glabrescentia, pallide castanea, chartacea; nervi primarii laterales utrinque 2, saepe alterni, prope basin orti (sed e pari superiore alter saepe prope mediam costam ortus), late arcuati, laminam usque ad apicem percurrentes, venulis reticulatis, supra impressi, infra prominentes; petioli 1-3 mm. longi, setulosi. *Inflorescentiae* brevissime corymboso-racemosae, 3-8-florae, glaberrimae, rhachi 2-6 mm. longa. *Bractee* ovatae, 1-2 mm. longae, cucullatae, dorso carinatae, acutae, fimbriato-ciliolatae; bracteolae bracteis similes, sed minores, nonnunquam paullo supra basin pedicelli ortae. *Pedicelli* usque 6 mm. longi, patuli. *Calyx* cupularis, 2-3 mm. longus et latus, explanatus 6-7 mm. latus, ultra medium fissus, segmentis triangularibus vel ovato-triangularibus acutis. *Corolla* campanulata, 5-6 mm. longa, 4-5 mm. lata, alba, lobis late deltoideis 2-3 mm. longis et latis apice obtusiusculis recurvis. *Staminum* filamenta subulata, ima basi attenuata, plana, 2 mm. longa, valde (maxime dorso) papillosa, margine basin versus parce longe ciliata; antherae lanceolato-ovoideae, circiter 1 mm. longae, apice deflexae, thecis breviter bicornibus. *Ovarium* depressoglobosum, 2 mm. diametro, 1.5 mm. altum, glabrum, basi disco obscuro brevissime 10-lobocinctum. *Stylus* corollam subaequans, columnaris, teres, stigmatibus subcapitato lobato. *Capsula* non visa; calyce fructifero (teste *Forrest*) atropurpureo.

The above description was prepared for publication before the appearance of Anthony's description of *G. notabilis* (*l.c. supra*); it is published here as being in some respects fuller than the latter.

This apparently very rare species, herbarium specimens of which bear a superficial resemblance to *Diplycosia pilosa* Blume, from Java, is at present known only from the vicinity of Tengyueh, Yunnan, growing "in dry thickets and amongst scrub, on dry stony slopes," at an altitude of 2400 metres (*Forrest* 26722). It provides a link, morphologically, with the series immediately following.

Series ATJEHENSES.

5. *G. atjehensis* J. J. Sm. in Fedde, Rep. Spec. Nov. **35**, 293 (1934); van Steenis in Bull. Jard. Bot. Buitenz. sér. 3, **13**, 205 (1934).

This species, at present known with certainty only from a single locality in Sumatra, forms an intermediate between the Series

Dumicolae and *Nummularioideae*. It is certainly allied to *G. nummularioïdes*, but not to *G. benguetensis* as suggested by van Steenis (*l.c.*). The urceolate corolla, paralleled also in certain forms of the next species, recalls that of the American species of *Brossaea*.

Series NUMMULARIOÏDEAE.

It is possibly overrating the distinctness of *G. nummularioïdes* to separate it serially from the remaining species of the section; this course has, however, the advantage of affording parallel treatment to that provided by the segregation of the solitary-flowered section *Eugaultheria* (p. 318) from the racemose section *Leucothoïdes* (p. 316). *G. nummularioïdes* is interesting as representing a highly successful reduced type derived from the apparently unsuccessful *Dumicolae*. Whereas the latter seem at the present day to be dying out, their offshoot already occupies a wider area than any other Asiatic species of the genus, and shows signs of eventually resolving itself into a multiplicity of forms or even species in much the same way as the similarly reduced and successful *Trichophyllae*.

6. ***G. nummularioïdes*** *D. Don*, Prodr. Fl. Nep. 150 (1825); Royle, Ill. Bot. Himal. t. 63, fig. 2 a-e (Aug. 1835) et p. 260 (Dec. 1835); C. B. Clarke in Hook. fil. Fl. Brit. Ind. 3, 457 (1882); Franch. in Nouv. Arch. Mus. (Paris), sér. 2, 10, 44 (1887); reimpr.: Pl. David. 2, 82 (1888); Koord. Exk.-fl. Java. 3, 10 (1912); J. J. Sm. apud Koord. et Valeton, Bijdr. Kenn. Boomsoort. v. Java, 13, 114 (1914), descr. opt.

Gaultheria repens Bl. Bijdr. Fl. Nederl. Ind. 857 (1826); DC. Prodr. 7 (2), 593 (1839).

Gaultheria Nummulariae DC. Prodr. 7 (2), 592 (1839).

Gaultheria sp., Griffith, Ic. Pl. As. 4, t. 518, fig. 2 (1854).

Pernettya repens (Bl.) Zoll. et Mor. in Mor. Syst. Verz. v. Zoll. a. Java gesamm. Pfl. 42 (1846), et in Zoll. Syst. Verz. Ind. Archip. gesamm. Pfl. 2, 138 (1854).

Gaultheria trichophylla Hassk. Retzia [ed. 1], 1, 108-110 (1855); ed. nov. (Hort. Bog. Descr.), 1, 148-150 (1858), descr. opt.; non Royle.

Gaultheria nummularia Hassk. ll. cc. (1855 et 1858), pro synonym. dub. *G. trichophyllae* Hassk. non Royle.

Brossea nummularioides [sic] O. Kuntze, Rev. Gen. Pl. 2, 388 (1891).

var. ***elliptica*** *Rehd. et Wils.* in Sargent, Pl. Wils. 1, 555 (1913).

The species exhibits a considerable amount of variation throughout its range, in leaf-size (and, to a less extent, in leaf-shape), in indumentum and in size and shape of corolla, but it has not been found possible to recognize any form as distinct except the variety *elliptica*. In Sumatra and Java the leaves tend to be of a uniformly small type, and the corolla is apparently urceolate or

at least cylindric ; this form can, however, be almost exactly matched by specimens from the Himalaya, which are in turn connected by numerous intermediates with large-leaved, campanulate-flowered forms from western China. Otto Kuntze's proposed varieties *normalis* and *glauca* appear quite untenable.

Section ii. *Amblyandra*.

A small isolated group of three closely allied species from the temperate regions on either side of the North Pacific, showing a simplified type of anther structure. The solitary flowers probably represent the terminal flower of a raceme, the numerous apparent bracteoles being in reality the bracts of the suppressed lateral flowers. As already noted, *G. nummularioides* exhibits the same phenomenon and may perhaps be regarded as a connecting link between the sections *Brossaeopsis* and *Amblyandra*.

CLAVIS SPECIERUM.

Pedunculi valde elongati, usque 3 cm. longi, glanduloso-pilosi, ex axillis foliorum summorum saepe valde redactorum orti ; bracteae numerosae, dissitae (Japonia).....1. *adenothrix*
 Pedunculi breves, corolla breviores usque vix duplo longiores, glabri vel apicem versus pilosi ; bracteae paucae (circiter 4), plus minus confertae (America bor.-occ.) :
 Corolla calyce hirsuto plus duplo longior ; folia acuta...2. *ovatifolia*
 Corolla calyce glabro vix longior ; folia subobtusata...3. *humifusa*

1. ***G. adenothrix*** (Miq.) Maxim. in Mém. Biol. 8, 610 (1872) et in Bull. Imp. Acad. Sci. St. Pétersb. 18, 44 (1873) ; Franch. et Sav. Enum. Pl. Jap. 1, 283 (1875) ; Miyoshi et Makino, Pocket Atl. Alp. Pl. Jap. 1, 10, t.v. fig. 30 (1906) ; Rehd. Man. Cult. Tr. & Shr. 717 (1927).

Andromeda (§*Lyonia*) *adenothrix* Miq. in Ann. Mus. Bot. Lugd.-Bat. 1, 31 (1863).

Brossea adenothrix (Miq.) O. Kuntze, Rev. Gen. Pl. 2, 388 (1891).

Diplycosia adenothrix (Miq.) Nakai in Bot. Mag. Tok. 35, 135 (1921) ; Nak. et Koidz. Trees and Shrubs Jap. Prop. ed. 1, 1, 164 (1922) ; ed. 2, 1, 225 (1927) ; Makino et Nemoto, Nipp.-Shokub.-Sôran (Fl. Jap.), ed. 1, 865 (1931) ; Terasaki, Nipp.-Shokub.-Zufu (Jap. Bot. Ill. Alb.) 744 (1933).

Nakai's transference of this plant to *Diplycosia*, made presumably on the basis of its exappendiculate anthers, shows a failure to grasp the essential characters of that genus, which are the fascicled flowers, pedicels with two connate apical bracteoles, and anther-thecae produced into unappendaged tubules ; the genus is, moreover, a definitely tropical and subtropical one, not extending north of the Philippines. *Gaultheria adenothrix* shows none of these features.

The relationship of this species to the next two has already been indicated by Rehder (*l.c.*, 1927).

2. **G. ovatifolia** A. Gray in Proc. Amer. Acad. **19**, 85 (1883); S. Brown, Alp. Fl. Can. Rocky Mount. 213, t. 58, fig. *b* (1907); Small in North Amer. Fl. **29** (1), 75 (1914); Armstr. et Thornb. Field Book West. Wild Flow. 342, fig. ad 343 (1915); Rydb. Fl. Rocky Mount. 642 (1917); Bean, Trees and Shrubs, **3**, 174 (1933).

G. Myrsinites forma, A. Gray, Synopt. Fl. North Amer. ed. 2, **2** (1), 26 (1886).

Intermediate in most of its characters between the two other species of the group. The indumentum is very similar to that of *G. adenothrix*.

3. **G. humifusa** (Grah.) Rydb. in Mem. New York Bot. Gard. **1**, 300 (1900); F. E. et E. S. Clements, Rocky Mount. Flow. 86, t. 15, fig. 6 (1914); Small in North Amer. Fl. **29** (1), 75 (1914); Rydb. Fl. Rocky Mount. 642 (1917); Jepson, Man. Flow. Pl. Calif. 744 (1925); Rehd. Man. Cult. Tr. & Shr. 716 (1927).

Vaccinium humifusum Grah. in Edinb. New Philos. Journ. **11**, 193 (1831).

Gaultheria Myrsinites Hook. Fl. Bor.-Amer. **2**, 35, t. 129 (1834); DC. Prodr. **7** (2), 592 (1839).

Brossea myrsinites (Hook.) O. Kuntze, Rev. Gen. Pl. **2**, 388 (1891).

Occasionally develops a sparse straggling indumentum on the stems, similar to that of *G. ovatifolia*, and is also sometimes very minutely whitish-puberulous.

Section iii. **Leucothoides.**

This section, characterized by the subopposite or alternate bracteoles at about the middle of the pedicel (more rarely near the base or close to the calyx), and by usually obovate to oblanceolate leaves, contains the largest number of Asiatic species and is certainly capable of further subdivision. It is hoped to attempt this on a future occasion. The group has its centre of distribution in the eastern Himalaya and south-western China, with extensions into southern India and Ceylon, the Malay Peninsula, Sumatra, Java, Celebes and New Guinea.

The group appears to be a natural one, but the species are recognizable more by a combination of characters than by any one infallible criterion. Thus the corolla is almost always decidedly urceolate, but a conspicuous exception is *G. Griffithiana* Wight, in which the corolla is shortly campanulate with rather large triangular lobes; the species is, however, clearly related to other more typical members of the group. The flower is normally

pentamerous, but tetramerous flowers are frequent in *G. tetramera* W. W. Sm. The leaves are usually broadest above the middle, with a more or less cuneate base, but in *G. Hookeri* C. B. Cl. (*G. Veitchiana* Craib) and a few others the leaves are often more ovate in outline, with a distinctly rounded, truncate or even subcordate base. In *G. semi-infera* (C. B. Cl.) Airy-Shaw, the ovary tends to become inferior. The anthers of *G. discolor* Nutt. are almost exappendiculate. A wide range is found in the position of the bracteoles, which may occur, in different species, anywhere from the base to the apex of the pedicel; in *G. Forrestii* Diels, and in all the Malayan species, they are apical.

Most workers on this group have probably been impressed by the remarkable similarity in general outward morphology between *Gaultheria Griffithiana* and *Leucothoë Griffithiana* C. B. Clarke. There seems little doubt that this is no mere coincidence. *G. Griffithiana*, though unquestionably a species of *Gaultheria*, provides an almost perfect link between that genus and *Leucothoë* Sect. *Euleucothoë* and is certainly one of the more primitive members of Sect. *Leucothoides*. It will be recalled that the principal differences between *Leucothoë* and *Gaultheria* lie in the staminal structure, the fruiting calyx and the seeds. The latter genus may be regarded as an advanced type of the former, adapted for seed-dispersal by the agency of birds. *Leucothoë*, doubtless relying mainly on the wind to scatter its light, winged seeds, is evidently, judging by its present geographical distribution, a less successful type than *Gaultheria*, whose fleshy and often brightly coloured "fruits" must be a strong attraction to birds. The smooth, hard, unwinged testa of *Gaultheria* seeds may well be a concomitant adaptation, enabling them to withstand digestion by the birds which feed upon them and so to pass through unaffected. (Cf. van Steenis in Bull. Jard. Bot. Buitenz. sér. 3, 13, 405: 1935).

The following described species are referable to this section: *G. fragrantissima* Wall., *G. Griffithiana* Wight, *G. Forrestii* Diels, *G. caudata* Stapf, *G. Wardii* Marq. et Airy-Shaw, *G. Hookeri* C. B. Cl. (*G. Veitchiana* Craib), *G. discolor* Nutt., *G. semi-infera* (C. B. Cl.) Airy-Shaw and *G. tetramera* W. W. Sm. (all from the Himalaya and South-West China); *G. Leschenaultii* DC. (South India) and *G. rudis* Stapf (Ceylon). Several undescribed species remain to be segregated from Chinese and Indian material. In the Malayan region there is a closely allied group in which the flowers are borne in leafless terminal panicles or in leafy racemes, and the bracteoles are consistently apical: this includes *G. malayana* Airy-Shaw (Perak), *G. punctata* Bl. (Sumatra & Java), *G. celebica* J. J. Sm. (Celebes), *G. novaguineënsis* J. J. Sm., *G. Pullei* J. J. Sm., *G. calyculata* Wernh., and *G. mundula* F. Muell. (New Guinea). In addition to the species listed, the following form a small related group characterized by the more or less sympodial relation of the inflorescence to the main vegetative axis: *G. pyrolifolia* Hook. f.

et Thoms. (E. Himalaya); *G. pyroloïdes** Miq. (Japan); *G. cuneata* (Rehd. et Wils.) Bean and *G. prostrata* W. W. Sm. (S.W. China); *G. Itoana* Hay. (Formosa); *G. benguetensis* Copel. (Philippines); *G. borneënsis* Stapf (Borneo).

Section iv. **Eugaultheria.**

The type species of the genus *Gaultheria* is the widespread North American species, *G. procumbens* L., characterized by solitary flowers bibracteolate at the apex of the pedicel. Those species which agree with *G. procumbens* in these essentials are therefore here assembled to form what must be considered the type section of the genus. *Eugaultheria*, however, containing, as it does, the most reduced species known in the genus, cannot be considered "typical" of *Gaultheria*. These reduced species nevertheless represent a highly successful type—successful, that is, under present conditions. The majority are microphyllous plants adapted to life in an alpine environment at considerable altitudes, their headquarters being in the high mountains of the Sino-Himalayan ranges, where they have split up into a large number of closely allied forms, a process which may indeed still be taking place. *G. procumbens*, however, representing a distinct series within the section, is a broad-leaved type, suited to more lowland conditions, and as such occupies a large area in the woodlands of temperate North America, where its remarkable uniformity practically throughout its range contrasts strongly with the protean variety of the Sino-Himalayan group. The discontinuous distribution of the small series *Hispidulae* is interesting, for in this case it cannot well be argued (as was done, above, for the series *Dumicolae*) that a primitive and unsuccessful type is concerned. The two species of this series, *G. hispidula* (L.) Muhlenb. and *G. suborbicularis* W. W. Sm., represent the last word in reduction within the genus. The former, occurring in Japan and temperate North America, frequents (at least in the latter country) woods and sphagnum bogs—habitats similar to those favoured by a plant of very similar habit, *Oxycoccus Oxycoccus* (L.) MacM.—, whilst *G. suborbicularis* is one of the high alpine plants of western Yunnan.

The opposite apical position of the bracteoles is a character towards the acquisition of which evolution in *Gaultheria* has not

* This name was ascribed by Miquel (Ann. Mus. Bot. Lugd.-Bat. **1**, 30 : 1863) to "Hook. fil. et Th. herb. Ind. or." There is, however, no evidence that this name was ever used or even proposed by the latter authors. The type sheet from Herb. Hook., seen by Miquel, is written up "*G. pyrolaefolia* H. f. et T." in Hooker's handwriting. Miquel erroneously identified the Japanese plant with the Himalayan species which he had seen in Hooker's herbarium and which was later described by C. B. Clarke (Fl. Brit. Ind. **3**, 457 : 1882) as "*G. pyrolaefolia* Hook. f. ms." The epithet *pyroloïdes*, therefore, though evidently a mistake for *pyrolifolia*, should be credited to Miquel and, since it was accompanied by a description, can legitimately be used for the Japanese species, Takeda's proposed alteration to *Miqueliana* (Bot. Mag. Tok. **32**, 195 : 1918) being consequently superfluous.

infrequently tended. Compare also *Diplycosia* and *Pernettyopsis*, in which they constantly occupy this position, and the related *Theaceae-Ternstroemioidae* (*Ternstroemia*, *Annesleya*, etc.), in which their position and form are very similar, though here they are often deciduous (cf. Hook. Ic. Pl. **34**, t. 3342, p. 3: 1937). Apical bracteoles appear to represent a kind of evolutionary climax.

A parallel may perhaps be traced in the form of the corolla. As sympetaly is commonly derived from polypetaly, so, surely, "stenostomy" may be regarded as a development from "euryostomy," or (lest this be Greek to some) an "urceolate" or pinched-at-the-mouth corolla as derived from a "campanulate" or wide-mouthed type, an adaptation for restricting the type of insect visitor that can effect cross-fertilisation. As mentioned already (p. 316), the section *Leucothoides* is almost uniformly characterized by the urceolate type; but *Gaultheria Griffithiana* Wight has lagged behind in this respect and has retained the earlier campanulate type, appearing somewhat anomalous among its near relatives. In *Eugaultheria*, on the other hand, although bracteolar evolution has apparently proceeded as far as it can (or at any rate probably *will*), the corolla generally conforms to the more primitive campanulate type; in *G. procumbens*, however, the corolla is subcylindric with a leaning towards the urceolate form, while *G. cardiosepala* Hand.-Mazz. (series *Trichophyllae*) has a definitely urceolate corolla. The urceolate type of corolla may be regarded as another evolutionary climax in the *Ericaceae*.

Series 1. PROCUMBENTES.

1. ***G. procumbens*** L. Sp. Pl. ed. 1, 395 (1753); G. Don, Gen. Syst. **3**, 839 (1834); DC. Prodr. **7** (2), 592 (1839); Britton et Brown, Ill. Fl. North. States & Can. **2**, 693 (1913); Small in North Amer. Fl. **29** (1), 75 (1914); Alexander in Addisonia, **12**, 53, t. 411 (1927).

G. humilis Salisb. Prodr. Stirp. Hort. Chap. Allert. 289 (1796).

G. repens Raf. Med. Fl. **1**, 202, t. 40 (1828), non Blume.

Brossea procumbens (L.) O. Kuntze, Rev. Gen. Pl. **2**, 388 (1891).

forma **suborbiculata** Fernald in Rhodora, **22**, 155 (1920); Deane in Rhodora, **24**, 153 (1922).

forma **elongata** Svenson in Rhodora, **25**, 184 (1923).

forma **accrescens** Fernald et Hodgdon in Rhodora, **36**, 129, t. 283 (1934).

The type species of the genus *Gaultheria*, *G. procumbens* is morphologically one of the most isolated species known. Possibly its nearest living relative is *G. pyroloides* Miq., from Japan, the shape, texture and venation of whose leaves are not very dissimilar, though in characters of inflorescence the two species differ widely. If this be the case, the section *Eugaultheria* must be regarded as at least diphyletic, since it is difficult not to trace the origin of the

Trichophyllae to species, allied to *G. pyroloides*, such as *G. cuneata* (Rehd. et Wils.) Bean and *G. prostrata* W. W. Sm., or their ancestors. This at least seems more natural than to imagine *G. procumbens* as the ancestral type of the *Trichophyllae*, not only on morphological but on phytogeographical grounds.

Reduction in leaf-dimensions and shortening of internodes and of pedicels have been the general accompaniments of the solitary flowers of *Eugaultheria*, but *G. procumbens* provides the exception to this. No other species of the section has such large leaves and only *G. dolichopoda* (described below) equally long pedicels.

While, therefore, the association of *G. procumbens* with the other members of the section may mean the juxtaposition of at any rate two independent lines of descent within the genus, it is perhaps the best scheme that can be devised, having regard to the exigencies of a linear arrangement.

Series 2. TRICOPHYLLAE.

The very closely allied species of this series constitute as it were the nucleus of the section *Eugaultheria*. Our knowledge of these critical forms is certainly far from complete, since every fresh collection from Upper Burma and Western Yunnan brings to light something new. The present treatment must therefore be regarded as at best provisional and probably unsatisfactory: full descriptions of the new forms here given the rank of species have not been supplied, since short diagnoses seem for the present to serve equally well. Further material may indicate the necessity for raising or lowering the rank of several of these forms.

G. dolichopoda (described below) may be recognised by its long pedicels; *G. cardiosepala* Hand-Mazz. has a conspicuously urceolate corolla; *G. trichophylla* Royle has (normally) only two horns per anther; and *G. nivea* (Anth.) Airy-Shaw has minutely puberulous stems. The key below may help to determine the remaining species, but it is only tentative; comparison with authentic specimens is essential in this critical group.

A possible derivation of the *Trichophyllae* would seem to be from Sect. *Leucothoides*, via the sympodial group mentioned above (p. 317-8), particularly species such as *G. cuneata* (Rehd. et Wils.) Bean and *G. prostrata* W. W. Sm. It is not, of course, suggested that these actually are their ancestors, but they are probably phylogenetically connected.

I am much indebted to the Regius Keeper, Royal Botanic Garden, Edinburgh, and to the Keeper, Dept. of Botany, British Museum, for the loan of material of this group.

CLAVIS SPECIERUM.

Pedicelli 5-9 mm. longi; folia oblongo-ob lanceolata, usque 15 mm. longa, 2-4 mm. lata, apicem versus regulariter et remotiuscule serrulata, rigide coriacea, glaberrima, costa subtus albida valida prominente; planta satis robusta, usque 25 cm. alta

2. *dolichopoda*

Pedicelli usque 3 (raro vix 4) mm. longi; plantae graciliores, humiliores:

Ramuli dense minutissime albido-tomentelli, setulis ferrugineis sparsis; folia oblonga, 5-8 mm. longa et 2-3 mm. lata, eciliata; fructus albus.....8. *nivea*

Ramuli praeter setulas ferrugineas sparsas vel densas glabri, raro sparse minute albo-puberuli; fructus caeruleus vel roseus vel albus:

Folia matura longe setuloso-ciliata, elliptico-oblonga, rarius obovata vel ovata; ramuli patenti-setulosi; disci glandulae parvae, deltoideo-subulatae; thecae plerumque uniaristatae

5. *trichophylla*

Folia matura eciliata; ramuli breviter adpresso-setulosi vel minute verruculosi vel subnudi; disci glandulae majores, late depresso-ovatae:

Folia linearia usque oblanceolato-linearia, 1.5-2.5 mm. lata:

Folia 5-9 mm. longa; sepala lanceolata; corolla breviter campanulata3. *thymifolia*

Folia majora, 7-14 mm. longa; sepala ovata; corolla oblongo-urceolata4. *cardiosepalae*

Folia elliptico-oblonga usque obovata, 3-8 mm. lata:

Folia plus minus chartaceo-coriacea, obovata, basi cuneata, apice rotundata, subtus pallide et saepe laete viridia, usque 15 mm. longa et 8 mm. lata, nervis subtus prominulis.....6. *hypochlora*

Folia rigide et crassius coriacea, elliptico-oblonga usque obovata, multo minus conspicue discoloria, usque 17 mm. longa et 5 mm. lata, plerumque acuta, nervis obscuris7. *sinensis*

2. ***G. dolichopoda*** *Airy-Shaw*, sp. nov., *G. thymifoliae* Stapf et *G. cardiosepalae* Hand.-Mazz. affinis sed omnibus partibus major, foliis conspicue serrulato-dentatis obtusioribus crassioribus, costa validiore, pedicello elongato usque 1.9 cm. longo distinctissima.

Gaultheria sp.n.? Marquand [et Airy-Shaw] in Journ. Linn. Soc. Bot. 48, 199 (1929).

S.E. TIBET. Tsangpo Gorge, near Sechen La, 3000-3300 m., along the open ridge in thick *Abies-Rhododendron* forest, 1 Dec. 1924, *Kingdon Ward* 6331 (typus, Herb. Kew.): "Undershrub of 6-9 in. growing in clumps. Berries pendent, bright blue." Burmese frontier, lat. 28°25'N., long. 97°55'E., 3000-3300 m., 21 Oct. 1931, *Kingdon Ward* 10,130 (Herb. Mus. Brit.): "A gregarious almost prostrate plant, plastering the smooth steep rock faces, or growing in moss under scrub *Rhododendron* and *Arundinaria*. Flowering shoots ascending erect, the Prussian blue berries pendent on half-inch pedicels. Grows in the precipitous gullies which, facing north, were choked with snow till July."

Clearly allied to the next two species, but the elongate pedicels are paralleled only by those of *G. procumbens* L. Unfortunately the flowers are unknown.

3. *G. thymifolia* Stapf MS., sp. nov., *G. cardiosepalae* Hand.-Mazz. arcte affinis, foliis minoribus 5–9 mm. longis, sepalis magis lanceolatis obtusioribus, imprimis corolla breviter aperte campanulata interdum purpureo-rubra, calyce fructifero laete roseo-rubro distincta.

UPPER BURMA. Chawchi Pass, among cool mossy granite boulders in the high-alpine zone, nearing the top of the pass, 3540 m., 3 July 1920, *Farrer* 1667 (Herb. Edin.): "Flowers white." On humus-covered boulders and as an undershrub in dwarf scrub in side valleys, 26°24'N., 98°48'E., 3300 m., June 1925, *Forrest* 26,867 (typus, Herb. Kew.): "Matted dwarf shrub of 2–4 inches. Flowers white." Advance Base, Seinghku Wang, 3000–3300 m., on precipitous earth and stone slopes in gullies which face south and are now clear of snow, 5 June 1926, *Kingdon Ward* 6849 (Herb. Kew.): "Creeping plant forming mats. Flowers maroon." "Berries bright rosy red (28 Sept. 1926)." (Also in ASSAM; vide *Kingdon Ward* 8605, sub *G. sinensis* Anth., infra, p. 325.)

Reddish flowers and fruit are noted by collectors as sometimes occurring also in *G. trichophylla* Royle.

4. *G. cardiosepala* Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. Kl. 1923, 60, 185 (1924); reimpr: Pl. Nov. Sin., Forts. 23, 6 (1924); Naturb. Südwest-China 129 (1927); Symb. Sin. 7, 792 (1936).

In addition to the two specimens collected and cited by Handel-Mazzetti, the following appear referable to this species:—

YUNNAN. Humus-covered ledges of cliffs on the eastern flank of the Tali range, 25°40'N., 3300–3600 m., Aug.–Sept. 1906, *Forrest* 4188 (Herb. Edin.): "Shrub of 3–6 inches. Flowers white." Dry ledges of cliffs on the eastern flank of the Tali range, 25°40'N., 3300–3600 m., July 1906, *Forrest* 4190A (Herb. Edin.): "Tufted shrub of 3–6 inches. Fruit pale purple. Flowers white?" Dry situations in pine forests on the Shweli-Salwin divide, 24°40'N., 2100–2400 m., March 1906, *Forrest* 5003 (Herb. Edin.): "Undershrub of 10–12 inches. Flowers white, tinged rose." Moist rocky banks on the margins of scrub on the eastern flank of the Tali range, 25°40'N., 3000–3600 m., July 1910, *Forrest* 6784: "Procumbent shrub of 6–12 inches. Flowers white, fruits blue." Open stony pasture and on humus-covered boulders in *Rhododendron* forest on the western flank of the Shweli-Salwin divide, 25°20'N., 3000–3300 m., Aug. 1912, *Forrest* 8931: "Dwarf shrub of 3–6 inches. In fruit, fruit pinkish white." On rocks and stony pasture, Shweli-Salwin divide, 25°20'N., 3000 m., Sept. 1913, *Forrest* 12,021 (Herb. Edin.). On banks amongst scrub and on alpine moorland on the Chien-chuan-Mekong divide, 26°30'N., 99°40'E., 3600–3900 m., Sept. 1922, *Forrest* 22,333: "Shrub of 4–7 inches. In fruit, fruits

white." Tali range, Sept. 1929, *Forrest* 28,077 (Herb. Edin.). Sine loc., *Forrest* 30,879 (Herb. Edin.). Mountains of the Yangpi River drainage basin, Aug. 1922, *Rock* 6272 (Herb. Edin.). Lotueshan, mountains of Labako, west of the Yangtze bend at Shiku, 3600 m., June 1923, *Rock* 9517 (Herb. Edin.): "Height 10 inches; flowers white."

UPPER BURMA. On open granite rocky hillsides facing south, Hpimaw, 3000-3300 m., 20 June 1914, *Kingdon Ward* 1691 (Herb. Edin.): "Dwarf undershrub forming carpets and patches. Flowers white." Like heather on the open slopes of the lower high-alpine zone, Hpimaw Hill, 3240 m., 10 May 1919, *Farrer* 895 (Herb. Edin.): "Foliage bronzed, flowers pinky white. Fruit snow white." N'Maikha-Salwin divide, 26°30'N., 3300 m., June 1931, *Forrest* 29,668 (Herb. Edin.). Hpimaw Pass, above 3300 m., 8 June 1929, *Sukoe* 10,080: "Herb; fl. pinkish white; stem hard, grows in patch."

The shape of the corolla immediately distinguishes this species from its allies. The fruiting calyx is evidently even more variable in colour than that of *G. trichophylla*. The leaves of *Rock* 9517 reach a length of 2 cm.

5. *G. trichophylla* Royle, Ill. Pl. Himal. t. 63, fig. 3, a-e (Aug. 1835)* et p. 260 (Dec. 1835); DC. Prodr. 7 (2), 592 (1839); C. B. Clarke in Hook. fil. Fl. Brit. Ind. 3, 457 (1882).

Brossea trichophylla (Royle) O. Kuntze, Rev. Gen. Pl. 2, 388 (1891).

Apart from the two Szechuan specimens cited below under var. *tetracme*, the only Chinese specimen seen that can be certainly referred to this species is the following:

W. YUNNAN. Moist, open, rocky situations on the eastern flank of the Tali Range, 25°40'N., 3600 m., Aug.-Sept. 1906, *Forrest* 4190 (Herb. Kew.; mixed with 4190A, *G. cardiosepala* Hand.-Mazz., in Herb. Edin.): "Shrub of 3-6 inches. Flowers white; fruit large, bright indigo blue, edible."

var. *tetracme* *Airy-Shaw*, var. nov. thecis biaristatis aristis longioribus fere 1 mm. longis, foliis potius ovatis vel ovato-oblongis quam oblongo-ellipticis.

G. trichophylla Royle sec Hook. fil. in Bot. Mag. 125, sub t. 7635 (1899), quoad plantam sinensem; Dunn in Journ. Linn. Soc. Bot. 39, 451 (1911); Rehd. et Wils. in Sargent, Pl. Wils. 1, 556 (1913); non Royle.

SZCHUAN. Near Tachienlu, 2700-4100 m., *Pratt* 833 (Herb. Kew.); sine loc. exact, 4200 m., July 1904, *Wilson* (Exped. Veitch.) 3915 (typus, Herb. Kew.): "Fls. white, fruit blue."

S. TIBET. Samchung La (Kharta), in stony soil, facing north, 4650 m., 20 June 1922, *Norton* (Exped. Mt. Everest) 172: "Flowers pink."

* Vide Sprague in Bull. Misc. Inf. Kew, 1933, 383, 386.

Dr. O. Stapf's manuscript notes show that he—at any rate provisionally—regarded this form with 4-horned anthers as specifically distinct. It does not, however, seem possible to correlate with this character any other really tangible differences (the leaf character mentioned being very slight), and I am therefore unwilling to accord these specimens more than varietal rank.

var. **obovata** *Airy-Shaw*, var. nov. foliis majoribus usque 1.3 cm. longis et 0.65 cm. latis obovatis rarius oblongo-obovatis.

UPPER BURMA. Seinghku Wang, 28°8'N., 97°24'E., on mossy boulders in the open valley, intertwined with dwarf *Salix* and forming a mat, 3300 m., 17 June 1926, *Kingdon Ward* 6944 (Herb. Kew.): "Corolla white, stigma crimson, anthers yellow, calyx tinged purple."

A specimen showing an approach to this variety in the size of the leaves, but retaining the oblong-elliptic shape typical of the species, is *Watt* 5219, collected May 1881 in SIKKIM at 4500 m. (Herb. Kew.).

6. **G. hypochlora** *Airy-Shaw*, sp. nov., *G. sinensi* Anth. affinis, foliis tenuiter chartaceo-coriaceis obovatis basi cuneatis apice rotundatis usque 8 mm. latis subtus (siccitate) pallide et saepe laete viridibus, nervis subtus prominulis, corolla ut videtur latius campanulata, bene distincta.

G. trichophylla Royle, vel aff., Auctt. Edin. in Notes Roy. Bot. Gard. Edinb. **17**, 92 (1929).

G. sinensis Anth. in Notes Roy. Bot. Gard. Edinb. **18**, 19 (1933), *p.p.*, quoad *Forrest* 13,428 et 14,735.

SZECHUAN. Hung-ya-hsien, 14 Aug. 1930, *W. P. Fang* 8221.

YUNNAN. On cliffs and humus-covered boulders on the Mekong-Salwin divide, 28°10'N., 3600 m., Oct. 1914, *Forrest* 13,428: "Prostrate shrub of 2–6 inches. In fruit, fruits deep blue." Open peaty pasture and on banks in *Rhododendron* thickets on the Mekong-Salwin divide, 28°12'N., 3600–3900 m., Aug. 1917, *Forrest* 14,735: "Matted shrub of 4–6 inches. Fruit deep clear blue."

UPPER BURMA. Chawchi Pass, common among rocks, etc., in cool shady places of the upper alpine woodland, 3300 m., 2 July 1920, *Farrer* 1676 (Herb. Edin.): "Flowers white. F.1737 is the same, from much higher up." Chawchi Pass, among mossy boulders and in silt, 3750 m., 18 July 1920, *Farrer* 1737 (Herb. Edin.): "See F. 1676. This is a higher-alpine state." Chimili woods, 3240 m., 4 Aug. 1919, *Farrer* 1191 (Herb. Edin.): "A prostrate trailer in moss, on boulders and silty banks of gullies in the upper woodland zone. Flower unknown, but the calyx round the Pyroloid capsule develops (from dull brown purple) to a most glorious white-lined 5-lobed 'flower' of brilliant lapis-lazuli blue." (The leaves in this specimen are smaller and less green below than usual).

ASSAM. Delei valley, in the *Abies-Rhododendron* forest, 3000 m., 31 May 1928, *Kingdon Ward* 8266 (typus, Herb. Kew.): "A creeping

plant, crawling over slabs of rock. Flowers few, solitary, snow white." Delei valley, 28°15'N., 96°35'E., in the *Tsuga-Rhododendron* forest, 3000–3300 m., 23 Aug. 1928, *Kingdon Ward* 8562 (Herb. Kew.): "A creeping plant, growing on rocky outcrops with north exposure. 'Berries' bright blue." Sources of the Irrawaddy, Adung valley, 28°20'N., 97°40'E., 3000–3300 m., 10 June 1931, *Kingdon Ward* 9628 (Herb. Mus. Brit.); "Flowers pure white. The long thread-like stems form a carpet amongst moss under the *Rhododendron* bushes in open places, *Abies* forest. (Shoots and midrib of leaf setose.) See no. 9885.*"

One of the numerous species detected as new by the late Dr. Stapf, who had used the epithet "myrtilloides" in manuscript: this name is, however, already preoccupied for a South American species. The present plant was included by Anthony under his very inclusive *G. sinensis*, but it is evident that this group requires somewhat more critical treatment. *G. hypochlora* can be readily distinguished from the plant which Anthony has designated as the type of *G. sinensis* by the thinner texture of the markedly obovate leaves, which frequently dry a very characteristic light clear green on the underside. The stems are occasionally sparsely and minutely white-puberulous when young.

7. *G. sinensis* Anth. in Notes Roy. Bot. Gard. Edinb. **18**, 19 (1933) *pro parte*; Hand.-Mazz. Symb. Sin. **7**, 793 (1936).

G. trichophylla Royle, var., Auctt. Edin. in Notes Roy. Bot. Gard. Edinb. **17**, 51 (1929).

The following collections are an excellent match of the type specimen (*Forrest* 14,216) from the Tibeto-Yunnan frontier:

UPPER BURMA. Seinghku Wang, 28°18'N., 97°24'E., 3900 m., on limestone gravel or grassy slopes amongst dwarf *Rhododendron*, 10 July 1926, *Kingdon Ward* 7094 (Herb. Kew.): "Flowers cream, with red calyx. Stigma crimson."

ASSAM. Delei valley, 28°15'N., 96°35'E., 3300–3600 m., growing on steep earth screes and rocky faces, amongst scrub *Rhododendron*, 28 Aug. 1928, *Kingdon Ward* 8605 (Herb. Kew.): "Creeping plant, in fruit, berries dark rose." (Apparently growing in association with *G. thymifolia*, since sterile specimens of the latter were found mixed with this gathering.)

As indicated above, under *G. hypochlora*, I believe Anthony's conception of the present species to be heterogeneous. The following varieties are therefore proposed:

var. **maior** Airy-Shaw, var. nov. foliis subduplo majoribus plerumque oblanceolatis nec oblongo-obovatis usque 16 mm. (nec 8 mm.) longis et 5.5 mm. (nec 4 mm.) latis acutioribus nervis supra minus conspicue impresso-reticulatis.

G. trichophylla Royle, var., Auctt. Edin. in Notes Roy. Bot. Gard. Edinb. **14**, 136 (1924).

* No. 9885 is not this species, but is *G. sinensis* var. *crassifolia* (p. 326).

G. sinensis Anth. l.c., p.p., quoad *Forrest* 12,938 et 20,040.

YUNNAN. In regione frigide temperata jugi Schöndsu-la inter fluvios Landsang-djiang (Mekong) et Lu-djiang (Salween), 28°4', sub fruticibus, substr. micoschistaceo, 3850 m., 22 Sept. 1915, *Handel-Mazzetti* 8243 (Herb. Edin.): "Fr. caerulei." Open sandy moist situations on the Kari pass, Mekong-Yangtze divide, 27°40'N., 3300 m., Aug. 1914, *Forrest* 12,938 (typus, Herb. Kew.): "Prostrate shrub of 10-12 inches. In fruit, fruits bright blue." Sine loc., *Forrest* 30,556 (Herb. Edin.). A smaller form of this variety, somewhat approaching the type of the species, is *Forrest* 28,035 (Herb. Edin.) from the Tali range, Oct. 1929.

S.E. TIBET. Tsarong: moist alpine pasture on the Salwin-Kiu-chiang divide, 28°24'N., 98°24'E., 3900 m., Aug. 1921, *Forrest* 20,040: "Prostrate or semi-prostrate shrub of a few inches. In fruit, fruits blue." (Also in UPPER BURMA; vide *Kingdon Ward* 6845, sub var. *crassifolia*, infra.)

var. **crassifolia** *Airy-Shaw*, var. nov. foliis nitidulis magnitudinis var. *maioris* sed crassioribus et manifeste obovatis, iis *G. hypochlorae* forma similibus sed minoribus saepe deflexo-apiculatis.

G. sinensis Anth. in Notes Roy. Bot. Gard. Edinb. 18, 19 (1933), p.p., quoad *Forrest* 19,286.

S.E. TIBET. On ledges of cliffs and humus-covered boulders on the Salwin-Kiu-chiang divide, 28°40'N., 98°15'E., alt. . . . , Oct. 1919, *Forrest* 19,286 (typus, Herb. Kew.): "Prostrate shrub of 1-2 inches. In fruit, fruits indigo blue."

UPPER BURMA. Advance Base, Seinghku Wang, 3000 m., on rocks in open meadows, 4 June 1926, *Kingdon Ward* 6845 (Herb. Kew.): "Dwarf prostrate undershrub with ascending stems. Flowers white, nodding, anthers bright yellow. Berries blue." (Flowering specimens of var. *maior* were found mixed with this gathering). Sources of the Irrawaddy, Adung valley, 28°20'N., 97°40'E., 3900 m., 29 June 1931, *Kingdon Ward* 9628A (Herb. Mus. Brit.): "Same as no. 9628?*" Ibid., 3900 m., 31 July 1931, *Kingdon Ward* 9885 (Herb. Mus. Brit.): "A minute prostrate creeping plant, freely branched and forming an extensive and close film-like mat over the thick beds of moss in the Fir forest. Fruits globular, green at first, bright scarlet when ripe. Leaves, when young, with short bristles on the margin; mature leaves leathery, shining, dark green above, paler below, glabrous, margin minutely serrate. Young shoots with short adpressed crimson bristles or hairs. (Same as no. 9628.*)" "

Ward's notes to his no. 9885 evidently refer in part to *G. suborbicularis* W. W. Sm., a small piece of which was found with the *G. sinensis* var. *crassifolia*. The latter is said to have blue fruits.

8. ***G. nivea*** (*Anth.*) *Airy-Shaw*, sp. nov., ab omnibus congeneribus Seriei *Trichophyllarum* ramulis dense minutissime albido-tomentellis

* No; no. 9628 is *G. hypochlora* (p. 324-5)

facile distinguenda ; *G. sinensi* Anth. (typicae) proxima, sed folia angustiora et acutiora.

G. sinensis var. *nivea* Anth. in Notes Roy. Bot. Gard. Edinb. **18**, 20 (1933) ; Hand.-Mazz. Symb. Sin. **7**, 793 (1936).

S.E. TIBET. Tsarong : peaty, stony meadows on the Salwin-Kiu-chiang divide, 28°40'N., 98°15'E., alt. . . . , July 1919, *Forrest* 19,269 (typus, Herb. Edin.) : " Plant of 1-2 inches. Flowers white."

YUNNAN. Open ledges of cliffs, humus-covered boulders and stony slopes on the Mekong-Salwin divide, 28°10'N., 3900 m., Sept. 1914, *Forrest* 13,310 : " Prostrate shrub of 2-4 inches. In fruit, fruits white."

Quite distinct in its minute tomentum from all the other species of this group. The small leaves are about the same length as those of typical *G. sinensis*.

Series HISPIDULAE.

Folia subacuta, basi subcuneata ; thecae breviter biaristatae ; fructus albus (Japonia ; America bor.).....9. *hispidula*

Folia plerumque utrinque rotundata vel vix apiculata ; thecae exaristatae ; fructus ruber (China mer.-occ.)...10. *suborbicularis*

9. ***G. hispidula*** (L.) *Muhlenb.* Cat. Pl. Amer. Sept. ed. 1, 44 (1813), ed. 2, p. ? (1818) ; *Bigel.* Fl. Bost. ed. 2, 165 (1824) ; ed. 3, 175 (1840) ; *L. C. Beck*, Bot. N. & Middle States, ed. 1, 216 (1833) ; *Hook.* Fl. Bor.-Am. **2**, 36 (1834).

Vaccinium hispidulum L. Sp. Pl. ed. 1, 352 (1753), excl. syn. ; *Michx.* Fl. Bor.-Am. **1**, 228, t. 23 (1803).

Arbutus filiformis Lam. Encycl. Méth., Bot. **1**, 228 (1784).

Arbutus thymifolia Ait. Hort. Kew., ed. 1, **2**, 72 (1789).

Oxycoccus hispidula (L.) Pers. Syn. Pl. **1**, 419 (1805).

Gaultheria serpyllifolia Pursh, Fl. Amer. Sept. **1**, 283 (1814).

Chiogenes serpyllifolia (Pursh) Salisb. in Trans. Hort. Soc. **2**, 94 (1817).

Glyciphylla hispidula (L.) Raf. in Amer. Monthly Mag. 192 (1819).

Schollera hispidula (L.) Steud. Nomencl. Bot. ed. 1, 746 (1821) ;

Roth ex Steud. op. cit. ed. **2**, **2**, 534 (1841).

Phalerocarpus serpyllifolius (Pursh) G. Don, Gen. Syst. **3**, 841 (1834) ; *Dunal* in DC. Prodr. **7**, (2), 577 (1839) ; *Klotzsch* in *Linnaea*, **24**, 68, (1851).

Lasierpa hispidula (L.) Torr. in Geol. Rep. New York, 152 (1839).

Phalerocarpus hispidula (L.) Heynh. Nomencl. **1**, 612 (1840-41).

Chiogenes hispidula (L.) Torr. et Gray ex Torr. Fl. New York, **1**, 450, t. 68 (1843) ; *Nieden* in Engl. Bot. Jahrb. **11**, 216 (1889) ; *Britton* et *Brown*, Ill. Fl. North. States & Can. **2**, 704 (1913).

var. **japonica** (A. Gray) *Makino* in Bot. Mag. Tok. **18**, 19 (1904) ; *Miyoshi* et *Makino*, Pocket-Atl. Alp. Pl. Jap. **2**, 104, t. lii. fig. 301 (1907).

Chiogenes hispidula Miq. in Ann. Mus. Bot. Lugd.-Bat. **1**, 29 (1863); Maxim. in Mél. Biol. **8**, 609 (1872) et in Bull. Acad. Imp. Sci. St. Pétersb. **18**, 43 (1873); Franch. et Sav. Enum. Pl. Jap. **1**, 282 (1875).

Chiogenes japonica A. Gray, Synopt. Fl. North Amer. **2**, 26 (1886); Drude in Engl. u. Prantl, Nat. Pflanzenfam. IV. **1**, 47 (1889); Nakai in Nak. et Koidz. Trees & Shrubs Jap. Prop. ed. **2**, **1**, 220 (1927); Makino et Nemoto, Nipp.-Shokub.-Sôran (Fl. Jap.) ed. **2**, 864 (1931); Terasaki, Nipp. Shokub. Zufu (Jap. Bot. Ill. Alb.) 907 (1933).

Differs from the American plant in the somewhat more obovate leaves with more cuneate base and in the shorter and less deeply bifid prolongations of the anther-thecae.

The slight tendency of the ovary to become inferior is apparently responsible for the chequered nomenclatural career of this species. An observation of Lamarck's (1784, *l.c.*), however, shows that this tendency is really very slight: "Les fleurs . . . ont . . . leur ovaire situé dans la corolle, & non au-dessous, comme je l'ai vu bien distinctement." Torrey (1843, *l.c.*) remarks that the calyx becomes more adnate to the ovary as the fruit ripens. It is clear, however, that too much importance should not be attached to this character in *Gaultheria*. The same tendency is seen in *G. semi-infera* (C. B. Clarke) Airy-Shaw (Sect. *Leucothoides*), a species closely related to *G. discolor* Nutt. whose status as a *Gaultheria* is beyond question. It is strange that Niedenzu, apparently the first botanist* to place *Chiogenes* in the *Gaultheriaceae* (1889, *l.c.*), did not attach more importance to the close morphological resemblance between *Ch. hispidula* and *Gaultheria trichophylla*. He observed (*l.c.* 190) a similarly 1-layered upper epidermis in these two species, but found on the whole a closer general agreement in the leaf-anatomy of *Chiogenes* with *Pernettya* than with other species of *Gaultheria*. Torrey,† Hooker and others comment on the similarity in the aromatic flavour of the fruits and leaves of *Chiogenes* to that of *Gaultheria procumbens*, placed in the present arrangement, on morphological grounds, at the opposite end of Sect. *Eugaultheria*.

* Asa Gray, though placing *Chiogenes* in *Vacciniaceae*, remarked that it was a genus "naturally related rather to *Gaultheria* and *Pernettya* than to *Vaccinium*" (Synopt. Fl. N. Amer. ed. **2**, **2** (1), 26: 1886). Bentham and Hooker were mistaken in stating (Gen. Pl. **2** (2), 564: 1876) that *Chiogenes* formed a connecting link between *Vacciniaceae* and *Ericaceae*, since it is in no way related to any species that has ever been referred to the former group.

† Dr. Torrey was evidently much puzzled by the structure of the fruit of this species. The following notes in his handwriting are attached to two specimens labelled "*Oxycoccus hispidulus* Pers." from Hooker's Herbarium at Kew: "I have made a mistake in describing the fruit of this plant. It is certainly a *berry* and is nothing like *Gaultheria*. 'Tis nearer *Oxycoccus* than any other genus." "The fruit is incorrectly described in my Flora. It is by no means a *Gaultheria*—neither does it agree in all respects with *Oxycoccus*."

10. **G. suborbicularis** W. W. Sm. in Notes Roy. Bot. Gard. Edinb. **8**, 186 (1914) et *l.c.* **14**, 125, 157, 212, 362 (1924); Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math.-Nat. Kl. 1923, **60**, 185 (1924); reimpr.: Pl. Nov. Sin., Forts. **23**, 6 (1924); Hand.-Mazz. Naturb. Südw.-China, 191 (1927), et Symb. Sin. **7**, 793 (1936).

Forrest collected this species a year after Kingdon Ward's original discovery, as well as after 1918; the notes to Forrest's earlier expedition have, however, not yet been published, and are therefore given here.

YUNNAN. Bei Ma Shan, Mekong-Yangtze divide, 28°20'N., 3900 m., on cliffs and boulders, rare, Aug. 1914, *Forrest* 13,283 (Herb. Edin.): "Trailing shrubby plant of 6-10 inches. In fruit, fruits bright crimson."

This interesting species bears a close resemblance to small slender specimens of *G. nummularioides* D. Don, but a glance at the bracteoles immediately discloses its true affinity. Both Smith and Handel-Mazzetti refer to the flowers as pentamerous, but I have been unable to detect any but tetramerous ones on the specimens available, and Dr. Stapf has also noted them as such on the three Forrest sheets in Herb. Kew. In view of the close relationship of this species with *G. hispidula* (L.) Muhlenb., in which the flowers are regularly tetramerous, it is probable that the occurrence of pentamerous flowers in *G. suborbicularis* is at least rare.

Handel-Mazzetti (1927, *l.c.*) speaks of the *fleshy lobes* of the red fruiting calyx. This is undoubtedly true of the "sky-blue" fruits of *G. trichophylla*,* referred to in the same passage; but, if it is safe to judge from dried specimens, the calyx-lobes in *G. suborbicularis* appear *not* to become fleshy, or only slightly so, while the calyx-tube enlarges very considerably into a berry-like structure, with the small almost unchanged calyx-segments persisting at the apex. A similar process occurs in *G. hispidula*, the capsule being almost completely surrounded and hidden, in which state the "fruit" has much the appearance of an inferior berry.

Gaultheria hispidula and *G. suborbicularis* represent at once the most reduced and the most advanced type within the genus. The completely prostrate habit, small size of all parts, tetramerous flowers, reduced anther-appendages, and tendency to perigyny are all evidences of this. A rather similar habit has been adopted in the series *Nummularioideae*, but reduction has not proceeded so far, since there is no observable leaning in the direction either of tetramery or of perigyny.

Section v. **Gymnobotrys.**

An essentially Malayan group, species being known from South-west China, Formosa, the Philippines, Indo-China, the Malay

* Probably the plant was not *G. trichophylla* itself, which appears to be rare in Yunnan, but one of its close allies.

Peninsula, Sumatra, Java and New Guinea. The branches are usually somewhat zig-zag; the leaves of a very uniform type, ovate to lanceolate, the base cordate or at least rounded (rarely subcuneate), the apex more or less caudate-attenuate. Except in *G. hirta* Ridley, from Perak, the indumentum is scanty, giving the plants a characteristically clean, smooth, bare appearance, which is enhanced by the rather small size of the bracts and the absence of perulae at the base of the inflorescence. The racemes are often almost as long as their subtending leaves, and the long, loosely spaced pedicels contribute towards the lanky aspect of these species.

Copeland (*l.c.* 60) has provided a tentative key to the group, and has included therein *G. celebica* J. J. Sm. (Celebes), *G. Pullei* J. J. Sm. and *G. calyculata* Wernh. (New Guinea); but, although the bracteoles are opposite and apical, the inflorescences are terminal, more or less leafy racemes, or panicles, and the leaves much smaller and of a different type, and the true affinity is evidently with *Leucothoïdes* through *G. celebica* and *G. punctata*. It is not clear why Copeland has separated *G. novaguineënsis* J. J. Sm. from *G. Pullei* and *G. calyculata* and placed it with the "allies of *G. nummularioides*": from the key to his three series (*l.c.* 57) it is apparently because *G. novaguineënsis* has "leaves generally under 2 cm. long"; but in other respects it seems closely allied to the two species mentioned.

Copeland is no doubt right in including *G. intermedia* J. J. Sm. in this group. I do not believe it is a hybrid between *G. leucocarpa* Bl. and *G. punctata* Bl., as suggested by Dr. J. J. Smith.

The origin of this section is probably to be sought in the same stock as that from which Sect. *Leucothoïdes* is derived and which is represented at the present day by the genus *Leucothoë* (excluding *Eubotrys* and Sect. *Eubotryoides*), the species of which show a markedly discontinuous distribution indicative of an ancient type (*cf.* Sect. *Brossaeopsis*, p. 309-10). The similarity in habit, leaf-shape and inflorescence is apparent even from casual inspection.

The writer wishes to record here his indebtedness to the late Dr. Otto Stapf for the permission, accorded before his death, to make use of a provisional MS. key to many of the Asiatic species of *Gaultheria* which he had drawn up in the course of his work for the Botanical Magazine (*vide* tt. 9174, 9228). It is greatly to be regretted that Dr. Stapf did not live to publish the complete results of his researches, since the genus was one in which he was especially interested, and also one with whose Old World representatives he was particularly well acquainted.

XLIV—MISCELLANEOUS NOTES.

The George Robert White Medal of Honour has been bestowed on the Director, Sir ARTHUR W. HILL, by the Massachusetts Horticultural Society.

Wayside Trees of Malaya.*—Mr. Corner is to be congratulated on having produced this very useful book with its volume of excellent illustrations of over 250 different species of trees. As many as 950 species are described and in addition to the full descriptions a great deal of useful and interesting information is given about the trees and their uses. As a further aid to the student the author has added a large number of very useful text figures, both in the introductory portion and under the genera, to illustrate important characters in flowers, fruits or leaves. The volume of text is divided into four parts. The first consists of a general account of how to name trees, giving details about the various organs—leaves, flowers, fruits, etc.—which are used in classification, followed by a general account of Malayan vegetation and of the trees of local interest in the different States with their localities. The second part of 40 pages is entirely occupied by elaborate and carefully constructed keys to the families and genera, which are constructed on distinctly original lines and should enable the non-botanist to identify any of the trees described without undue difficulty, especially as Mr. Corner has, as far as possible, selected characters which can be readily observed and are available throughout the year. One small criticism of the keys is of the constant use of the words “not so” as the alternative phrase in the couplet of distinguishing characters. In the first place it is not always easy to appreciate to what it applies, and in many cases it certainly does not apply to the whole of the statement with which it is contrasted. No doubt the use of the term has shortened the key, but its usefulness has been somewhat impaired in consequence.

The bulk of the book (pp. 95–726 incl.) consists of descriptions of the various families, genera and species, and the arrangement is alphabetical in all cases. The gymnosperms are placed at the end of the flowering trees, and the volume concludes with indices of the English, Malay and botanical names and of botanical and descriptive terms. The derivation of the generic and specific names which are given under the descriptions is a welcome feature which will be generally appreciated.

The student should have no difficulty in running down any tree he may be examining, as in addition to the Key in Part II, keys to the genera, where necessary, are given under each family and keys to the species, under the genus. In addition to the full descriptions of the genera and species, interesting particulars are given of the various species, whether they are native or introduced, and also many points of biological and morphological importance, as well as information about their economic value.

We are glad to recognise on the cover one of the Berok monkeys, which Mr. Corner has so successfully trained to collect tree specimens for him. The significance of the picture may not be understood

* *Wayside Trees of Malaya*, by E. J. H. Corner, M.A., F.L.S., Assistant Director of Gardens, Straits Settlements. Vol. I text, Vol. II plates, printed at Government Printing Office, Singapore, 1940, \$10.

outside Malaya, nor the allusion to it on the page facing Plate I in the second volume.

The volumes are a great tribute to the Government Printing Office, Singapore. The printing of the text and the reproduction of the fine photographs leave nothing to be desired.

The Indigenous Trees of Uganda.*—The large number of excellent photographs which adorn the pages of this book is a striking and very welcome feature. There are forty-two of them, and those of *Crataeva Adansonii* facing p. 36, *Albizia zygia* (p. 122), and *Musanga Smithii* (p. 150) make very pretty landscape pictures. The seventy-six line drawings, however, would have been much improved had they shown more botanical details.

For several years Kew has assisted Mr. Eggeling by supplying determinations of his collections, and for this help, as noted in the foreword, we have been well rewarded, since it has resulted in the production of this important work on the indigenous trees of the Protectorate. Descriptions of the more obvious characters of each species are given, and keys for their determination, whilst their distribution in Uganda is indicated. Considering the excellent format of the book, one is rather surprised and not a little pleased to find that it has been possible to print such a work at a place resting almost on the equator, and the author and Government Printer at Entebbe are to be warmly congratulated on the result.

It is to be hoped that in other books of this kind the recording of tentative herbarium determinations will not be included. Many of them are very ancient and no useful purpose is served by their publication.

Mr. Eggeling has been an assiduous collector of Uganda trees and shrubs, and it is mainly his own specimens which are quoted throughout the book. It seems a pity that those gathered by others could not also have been mentioned, for instance by such pioneers as M. T. Dawe, E. Brown, and E. G. Bagshawe, who all made large collections, and later R. Dümmer and J. D. Snowden, to mention only a few.

With respect to the arrangement of the families, the author of the book, being a forester, should know best which is most suitable for foresters. In my opinion, however, the alphabetical arrangement rather implies a lack of knowledge of taxonomic botany on the part of the forester, which some would perhaps resent, considering the comprehensive training they receive nowadays at the schools of forestry at Oxford, Edinburgh and other places. And if the forester has not the requisite botanical knowledge, he can scarcely think of his trees in the first place in terms of their *families*. He

* The Indigenous Trees of the Uganda Protectorate, by W. J. Eggeling, B.Sc., Ph.D., Senior Assistant Conservator of Forests, Uganda Protectorate, with a Foreword by Sir Arthur Hill, K.C.M.G., F.R.S., etc., being a thesis approved for the Degree of Doctor of Philosophy in the University of Edinburgh; Government Printer, Entebbe, Uganda, 1940, price 15s. net.

might know the generic name, and would then turn to the excellent index provided to find it. Or, failing knowledge of the generic name, he will turn to the key. But in this there is a very unfortunate omission. The beginning of the key to the *Dicotyledones* on p. xiv reads as follows :—

- “ 10. Gynaecium composed of 2 or more separate or nearly separate styles and stigmas.....11
 Gynaecium composed of 1 carpel or 2 or more united carpels with free or united styles, or if carpels free below then the styles or stigmas united.....12 ”

The first paragraph should read “Composed of 2 or more separate or nearly separate *carpels* with separate styles and stigmas.” That is how it is written in Hutchinson’s *Families of Flowering Plants*, from which the key has been mainly adapted. As the key stands many of the families included in No. 12 might equally well be referred to No. 11. For example, if we try to run down the *Hypericum* figured opposite p. 85, it will most certainly be considered to belong to No. 11, because there are two or more separate styles and stigmas ; and if we follow the key further *Hypericum* will be referred to *Annonaceae*, a family in which it has not hitherto been placed. This mistake is, therefore, particularly regrettable, and those who possess a copy of the book should make the addition as soon as possible ; after this the key seems to be quite satisfactory.

J. HUTCHINSON.

Gardening without Soil.*—“ If you are relatively inexperienced in growing plants, you may find soil a better medium for germinating certain seeds than the litter seedbed. This is more a question of convenience than anything else.” It is rather surprising to find this statement in a book intended to encourage the cultivation of plants for commercial and ornamental purposes with their roots immersed in an aqueous solution of mineral salts rather than in the soil in which we are more accustomed to see them grow. This and other statements are indicative of the author’s honesty in acknowledging that soilless cultivation presents difficulties peculiar to itself in spite of advantages such as the elimination of soil pests and diseases. That considerable interest has been aroused in this subject may be seen from the number of books which have recently been written about it, some of which have already been noticed in the Bulletin (K.B. 1938, p. 314, 1940, 139). The author of the book now under review is one of the pioneer workers in the development of soilless cultivation beyond the well-known method of water culture, which has been familiar to all students of plant physiology for many years. When one compares the rather sickly plants in jars of culture solution which are so often associated with water culture experiments with the tanks of flourishing tomatoes, potatoes and other crops

* The Complete Guide to Soilless Gardening, by W. F. Gericke, London, Putnam, 1940, pp. xvi+285, 60 figures. Price 12s. 6d. net.

which are figured in this book, one must agree that very considerable advances on the older methods have been made. For this reason alone Mr. Gericke's book is worthy of careful study by those engaged in teaching plant physiology. It should also be read by anybody interested in the mineral nutrition of plants, because much of the information which is given will be found useful by those who grow plants in soil in the ordinary way. The practical value of cultivation without soil will vary in different parts of the world, being most useful where high light intensity is accompanied by poor soil or even by desert conditions. In such localities the new technique may eventually play a part of some importance, but elsewhere it seems doubtful whether it will successfully compete with more orthodox methods of cultivation.

C. R. METCALFE.

This number completes the issue of the Kew Bulletin for the year 1940. It consists of seven numbers instead of ten, the reduction being due to the shortage of paper and also to the depletion of the scientific staff of Kew in consequence of the war.

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